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Observations on the Cattle Cycle [1]

By Harold F. Breimyer

Among all economic cycles that alternately bring cheer and despair to their participants and continuously challenge the ingenuity of analysts, none presents so rhythmic a pattern as does the cycle in cattle numbers. Many studies of the cattle cycle have been attempted but few published. This article sums up previous research and adds new interpretative analysis.

SINCE 1880, the inventory of the number of cattle on farms has swung up and down through five complete cycles. It is now midway through a sixth. Varying in length between 10 and 16 years and in amplitude between 23 and 35 percent, the several cycles have demonstrated a remarkable uniformity of pattern (fig. 1). Accompanying inventory cycles there have been equally pronounced but less regular cycles in number of cattle slaughtered each year, and even more pronounced cycles in prices of cattle.

Characteristics and consequences of the cattle cycle were forcefully brought to public attention when the price-decline phase of the current cycle arrived in 1952. In a reduction that must have appeared endless to disheartened producers, prices of cattle dropped from a United States average of $27.80 per 100 pounds in May 1952 (itself down $2.00 from the preceding May) to $14.50 in November 1953. After some recovery, market prices of cattle in November 1954 showed reductions from 3 years earlier ranging from 26 percent for Prime slaughter steers to 57 percent for slaughter cows. These price changes occurred as slaughter of all cattle and calves advanced from 26 million head in 1951 to 39½ million in 1954. Output of beef vaulted from 8.8 billion pounds to almost 13 billion. The American consumer was first restricted to the 55 pounds of beef available in 1951, then comparatively surfeited with 78 or 79 pounds in 1954.

These events stirred both popular and professional interest in studying the cattle cycle. Mysteries of the cycle have been examined before—usually at times of low prices. In the 1920's their study was a part of general price-and-supply analysis in which an attempt was made to associate production of a commodity in a given year with prices in a preceding year. Price-supply relationships for hogs were successfully established through the analytical device of the hog-corn price ratio (*3; 10*). But try as they might, economists could not demonstrate a similar connection between prices of cattle at one time and the volume of cattle production at a later time.

Failing in this price and supply analytical approach, research men pinned their faith on the

[1] This summarizes and partly repeats the text of a paper, "100 Million Cattle? A Review of Projections and Methods of Making Them," presented at the Western Farm Economics Association meeting, Estes Park, Colo., July 26, 1954.

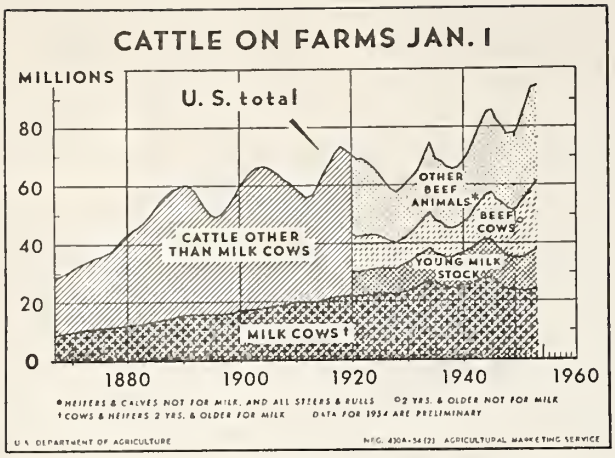

FIGURE 1.

empirical manifestations of the patterned cycle in cattle. The cycle has been the principal working tool for economic forecasts with respect to the cattle industry.

Originally, the cycle was reported as a cycle in prices of cattle. Later it was more often identified as a cycle in inventory numbers (*9*). It can also be thought of as a cycle in cattle slaughter or in beef supply. Insofar as cyclical trends in inventories, slaughter, and prices are causally linked, it makes no difference by what term the cycle is described. One author, Lorie (*6*), who is much impressed by a causal sequence as each cycle unfolds, insists that it is the same cycle however named. Usually, the cycle is now thought of as an inventory cycle.

Cycles in cattle, so clearly displayed by observed data, take a place alongside cycles in the industrial sector such as construction and investment and the overall business cycle as phenomena of economic life. In smoothness and regularity, the cattle cycle surpasses those familiar periodicities.

Industrial cycles have been receiving new attention recently (*1; 8*). It would not be surprising if research economists should soon rediscover the cattle cycle also as a demonstration in cyclical behavior worth probing.

For the cattle cycle, more than any recurring fluctuation within agriculture, resembles cycles of industrial origin. Basic to all such cycles is the management of capital goods of high investment cost and long productive life. In cattle those "goods" are breeding stock. A productive life of 5 years is generally considered necessary for the large investment in a cow to be returned—and then it is fully realized only if an adequate salvage price is received by sale of the discarded cow for beef.[2]

Two Schools of Thought

Not surprising, in view of this similarity to industrial cycles, is the conflict in interpretation of the cattle cycle between two schools of thought: (1) Cyclicality explained as self-generation, or (2) as due to outside influences.

In the theory of self-generation, each phase in a cycle progressively generates its succeeding phase. When prices of cattle are high, producers hold back stock for breeding. The supply of cattle for slaughter is reduced and prices are pushed still higher. Inventory numbers of cattle build up. As progeny of increased numbers of breeding stock reach slaughter age, annual slaughter starts upward. Eventually it increases a lot, and it reduces prices to a point that discourages further expansion of production and, later, results in liquidation of inventories. After inventories are reduced, the supply of cattle for current slaughter is again smaller. Prices then turn higher, and a new cycle begins.

In many ways this theory fits actual experience. The theory has been reported by several analysts. In illustrating the economic principle of the "Cobweb Theorem," Mordecai Ezekiel cites cycles in cattle as an example of variability in production caused by intermittent overresponses, first to high and then to low prices (*4*).[3] Lorie, though avoiding an explicit position as to whether a cycle is self-generated, stresses the "interrelationships among value, marketings, and numbers on farms (or production)." (*6*)

John Hopkins, on the other hand, in an Iowa bulletin of 28 years ago, argues strongly that cyclical trends in cattle come from outside stimuli. "The cattle cycles of the past 60 years are apparently due to forces from outside of the cattle industry. . . ." (*5*) C. A. Burmeister, longtime United States Department of Agriculture expert

[2] The intrepid theoretical researcher will find within the cattle cycle evidences of induced as well as autonomous investment and of the accelerator, though not of the multiplier.

[3] Ezekiel only made a brief note as to cycles in cattle and admitted there is more irregularity in actual cycles than would be explained by the cobweb theory.

on livestock, holds a similar view. He "is concerned with the distinctive features of each cycle in numbers, with particular reference to unusual conditions that have affected the industry at various times. . . ." (*2*) F. A. Pearson is another skeptic of automatic properties of the cattle cycle. He and his associates suggest that changes in feed supply are a leading external factor by which cycles in cattle production are begun (*7*).

Conceptual dilemmas are often resolved by referring to the nature of actual events. An increase in cattle production comes about because several million cattle producers individually decide—and are able—to raise more cattle. In making their decisions to increase or not to increase, producers give thought to every factor they believe to be meaningful. They consider the outlook for prices of cattle and they compare this with the outlook for other farming enterprises to which they could turn. They look at general political and economic developments. They are aware of limitations that restrict their freedom of choice. They may be limited by supply of feed, including range and pasture; by investment funds; by availability of alternative enterprises; or by their own training and experience, which may or may not fit them better for raising cattle than for other kinds of farming or ranching. On the basis of all these factors they make their plans.

We saw just after the war an example of how cattlemen can and do adjust their production according to their appraisal of conditions. In 1946 producers faced an end of the special wartime outlets for beef. They were uncertain as to the strength of consumer demand during the transition to peacetime, and feared a reduction in prices. They accordingly chose to reduce the size of their herds. Then when demand for beef remained strong for three years and prices advanced, they changed their minds and started an expansion.

The price of cattle is seen to enter into most decisions. Current prices are in principle less meaningful than expectations of prices in the future, but they are often the basis for guesses of future prices. Insofar as this is true, there is a substantial element of self-generation in the cattle cycle. In other respects self-generation is less evident. Cattle producers consider present and prospective forces other than price, such as strength of demand for meat, the weather, and range condition and feed supplies.

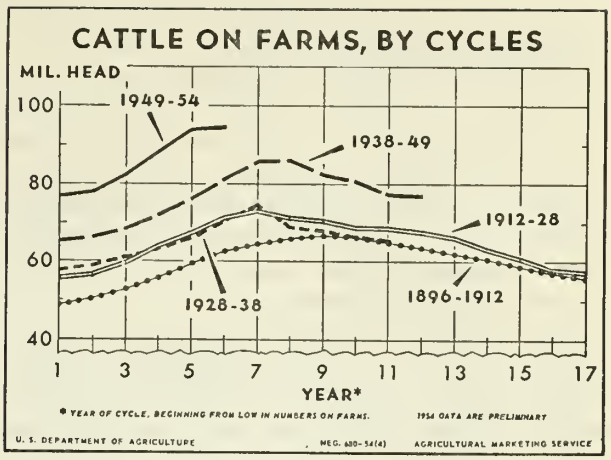

FIGURE 2.

In making their responses to *all* factors, producers are affected by the complicating features of large financial investment, long life cycle, and scarcity of alternatives. As a result, responses by cattlemen are not quick, simple and direct but take on the slow evolutions known as the cattle cycle. It is the special features of the cattle industry, converting all responses into cyclical responses, that largely account for the historical cattle cycle. The cyclical effect comes about regardless of whether the forces responded to arise from within or outside the cattle industry.

The Cycle as a Working Tool

Properly applied, the concept of a cycle in cattle is a valuable tool. The cycle is useful not as something that goes on and on clock-fashion, but for the continuity it gives to all short trends.

A free-hand graphic extension of a cyclical trend in cattle is still a reliable first approximation of short-run prospects. For this purpose the charting scheme of figure 2 is helpful. The time series as plotted in figure 1 is broken into the several separate cycles, which are then plotted superimposed on the same scale beginning with the year of the low point in inventories.

Accompanying the cycle chart is table 1, called a "balance sheet" of cattle numbers. In it the entire supply of cattle and calves each year is distributed into the several forms of disposition. The supply is total inventory at the beginning of the year, number of calves born in the calf crop, and number of cattle imported. Supply is disposed of

as the number dying, exported, slaughtered, and remaining as inventory at the end of the year.

The closing inventory so derived is never exactly the same as the actual numbers reported by the Crop Reporting Service the following February. A correction factor is required to bring the table into balance. The factor is in reality a sum of the errors in each of the individual series, most of which are estimates based on surveys and therefore involve a degree of error.

Like all balance sheets, this for cattle is an accounting form. It is not an instrument of prediction, but it can be used as an aid in prediction and it definitely will insure comparability of all separate forecasts (inventory, slaughter, death loss). The balance sheet in table 1 contains associated data to help in prediction—the number of cows and heifers on farms and the percentage calf crop. If the inventory of cows for, say, 1955 can be anticipated with fair accuracy and the percentage calf crop also is forecast, a long start is made toward predictions of all series for cattle in that year.

A different kind of balance sheet, a "progressive balance sheet," (tables 2, 3, and 4) offers more promise of assistance in forecasting both inventory numbers of cattle and the number slaughtered each year. In it the number of each age and sex class of animals on farms each January is traced through the following year, either into slaughter or deaths or into closing inventories of the next older age class. There is considerable regularity in the disposition of each class from year to year or at successive phases of the cycle. Forecasts based on this progressive balance sheet would have much validity.

Unfortunately, basic data are not set up by the classes necessary to construct a complete balance sheet. The number of "other" calves in inventories are not classified by sex and the number of steers and bulls are not classified by age. The calf crop is not reported separately by calves born

TABLE 1.—*Balance sheet of numbers of cattle and calves produced, disposed of, and on farms, United States, 1924 to date*

Year	Supply						Disappearance									
	Beginning inventory		Calves saved		Imports	Total supply	Slaughter			Exports	Death loss			Derived closing inventory	Correction factor	Actual closing inventory
	Total	Cows and heifers 2 years and over	Number	Percentage of cows and heifers Jan. 1			Cattle	Calves	Total		Cattle	Calves	Total			
	1,000 head	*1,000 head*	*1,000 head*	*Percent*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*
1924	65,996	34,257	25,515	74	144	91,655	14,750	9,804	24,554	61	1,313	1,870	3,183	63,857	−484	63,373
1925	63,373	33,779	25,035	74	175	88,583	14,704	9,936	24,640	81	1,279	1,863	3,142	60,720	−144	60,576
1926	60,576	32,704	24,843	76	221	85,640	14,781	9,354	24,135	23	1,269	1,788	3,057	58,425	−247	58,178
1927	58,178	31,690	23,937	76	445	82,560	13,413	8,478	21,891	19	1,188	1,670	2,858	57,792	−470	57,322
1928	57,322	31,157	24,091	77	536	81,949	12,028	7,651	19,679	11	1,113	1,859	2,972	59,287	−410	58,877
1929	58,877	31,437	24,355	77	505	83,737	12,038	7,406	19,444	8	1,097	1,795	2,892	61,393	−390	61,003
1930	61,003	32,194	25,087	78	234	86,324	12,056	7,761	19,817	7	1,203	1,944	3,147	63,353	−323	63,030
1931	63,030	33,629	26,056	77	95	89,181	12,096	8,057	20,153	4	1,328	1,915	3,243	65,781	20	65,801
1932	65,801	35,335	27,568	78	106	93,475	11,980	7,970	19,950	4	1,349	1,991	3,340	70,181	99	70,280
1933	70,280	37,282	28,935	78	82	99,297	13,107	8,564	21,671	3	1,372	2,040	3,412	74,211	158	74,369
1934 [1]	74,369	39,609	30,240	76	66	104,675	19,509	11,759	31,268	10	1,437	2,157	3,594	69,803	−957	68,846
1935 [1]	68,846	37,233	27,473	74	378	96,697	14,805	9,632	24,437	3	1,561	2,268	3,829	68,428	−581	67,847
1936 [1]	67,847	36,244	28,201	78	410	96,458	15,901	10,008	25,909	4	1,349	2,070	3,419	67,126	−1,028	66,098
1937	66,098	35,331	28,033	79	507	94,638	15,254	10,304	25,558	4	1,405	2,081	3,486	65,590	−341	65,249
1938	65,249	34,598	27,787	80	434	93,470	14,822	9,306	24,128	3	1,308	1,928	3,236	66,103	−74	66,029
1939	66,029	34,587	28,879	83	764	95,672	14,621	9,191	23,812	3	1,298	1,935	3,233	68,624	−315	68,309
1940	68,309	35,616	29,886	84	644	98,839	14,958	9,089	24,047	4	1,397	1,992	3,389	71,399	356	71,755
1941	71,755	36,819	31,868	87	749	104,372	16,419	9,252	25,671	6	1,461	2,118	3,579	75,116	909	76,025
1942	76,025	38,891	34,388	88	669	111,082	18,033	9,718	27,751	5	1,560	2,349	3,909	79,417	1,787	81,204
1943	81,204	41,118	34,797	85	653	116,654	17,845	9,940	27,785	4	1,734	2,560	4,294	84,571	+763	85,334
1944	85,334	43,225	37,040	86	358	122,732	19,844	14,242	34,086	10	1,734	2,772	4,506	84,130	1,443	85,573
1945	85,573	44,226	35,155	79	512	121,240	21,694	13,657	35,351	20	1,637	2,678	4,315	81,554	681	82,235
1946	82,235	42,929	34,643	81	558	117,436	19,824	12,176	32,000	43	1,549	2,547	4,096	81,297	−743	80,554
1947	80,554	42,330	34,703	82	85	115,342	22,404	13,726	36,130	10	1,464	2,466	3,930	75,272	1,899	77,171
1948	77,171	40,625	33,125	82	462	110,758	19,177	12,378	31,555	7	1,388	2,247	3,635	75,561	1,269	76,830
1949	76,830	39,781	33,748	85	434	111,012	18,765	11,398	30,163	5	1,507	2,333	3,840	77,004	+959	77,963
1950	77,963	40,596	34,846	86	461	113,270	18,624	10,504	29,128	8	1,441	2,299	3,740	80,394	1,631	82,025
1951	82,025	42,118	35,706	85	239	117,970	17,100	8,913	26,013	8	1,534	2,338	3,872	88,077	−233	87,844
1952	87,844	43,959	37,992	86	140	125,976	18,668	9,408	28,076	11	1,607	2,447	4,054	93,835	−198	93,637
1953 [2]	93,637	46,584	40,914	88	198	134,749	24,556	12,270	36,826	15	1,567	2,497	4,064	93,844	833	94,677
1954 [2]	94,677															

[1] Slaughter includes Government purchases.
[2] Preliminary.

TABLE 2.—*Distribution of estimated milk heifer calf crop, 1944–53*

Year	Milk heifer calves born [1]	Number remaining on hand		Percentage retained		Percentage of milk heifer crop slaughtered or died		
		Jan. 1 of following year as milk heifer calves	Jan. 1 of second year as milk heifers 1 to 2 years old	Jan. 1 of following year	Jan. 1 of second year	First year	Second year	During 2 years
	1,000 head	*1,000 head*	*1,000 head*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1944	12, 007	6, 772	5, 758	56. 4	48. 0	43. 6	8. 4	52. 0
1945	11, 166	6, 270	5, 524	56. 2	49. 5	43. 8	6. 7	50. 5
1946	10, 880	6, 317	5, 550	58. 1	51. 0	41. 9	7. 1	49. 0
1947	10, 736	6, 004	5, 327	55. 9	49. 6	44. 1	6. 3	50. 4
1948	10, 248	6, 081	5, 394	59. 3	52. 6	40. 7	6. 7	47. 4
1949	10. 240	6, 208	5, 510	60. 6	53. 8	39. 4	6. 8	46. 2
1950	10, 268	6, 374	5, 719	62. 1	55. 7	37. 9	6. 4	44. 3
1951	10, 111	6, 549	5, 974	64. 8	59. 1	35. 2	5. 7	40. 9
1952	10, 175	6, 676	6, 032	65. 6	59. 3	34. 4	6. 3	40. 7
1953	10, 638	6, 820	----------	64. 1	----------	----------	----------	----------

[1] Estimated by assuming that the percentage calf crop *by States* is the same for milk and beef cows, and that 50 percent of calves are heifers. This slightly underestimates the milk heifer crop. These are not official estimates.

to milk cows and to other cows, although fairly acceptable working estimates can be made. Death losses are not separated by class. Moreover, there are substantial inconsistencies in age class as reported by producers. Producers do not always identify "yearlings" and "2-year-olds" with strict regard for the calendar. Finally, data on the sex class of cattle slaughter are available only for slaughter under Federal inspection, and even the inspected data are of limited usefulness because the identity at time of slaughter is not necessarily the same as at time of inventory. A "heifer" slaughtered, for example, may have been a milk heifer, a milk heifer calf, a beef heifer, or an "other" calf when the January inventory was taken.

A few fragmentary sections of a progressive balance sheet have been developed. Three illustrative examples are presented here. The first (table 2) is the most reliable. It shows how the estimated number of heifer calves born to milk cows can be traced into the number saved as milk heifer calves at the end of the first year and as milk heifers 1 to 2 years of age after a second year. The second (table 3) contains similar data for heifer calves born to beef cows, except that inventory statistics are available only on the number of beef heifers still on hand at the end of the second year. The third (table 4) demonstrates how the size of annual cow slaughter can be related to cow and heifer inventories, and the change in them. Heifers on feed (estimated inexactly) are assumed to go into slaughter as heifers but

TABLE 3.—*Distribution of estimated beef heifer calf crop, 1944–53*

Year	Beef heifer calves born [1]	Number remaining on hand January 1 of second year as beef heifers 1 to 2 years old	Percentage beef heifer crop	
			Retained January 1 of second year	Slaughtered or died during 2 years
	1,000 head	*1,000 head*	*Percent*	*Percent*
1944	6, 513	4, 859	74. 6	25. 4
1945	6, 412	4, 636	72. 3	27. 7
1946	6, 442	4, 518	70. 1	29. 9
1947	6, 616	4, 657	70. 4	29. 6
1948	6, 314	4, 754	75. 3	24. 7
1949	6, 624	5, 082	76. 7	23. 3
1950	7, 154	5, 881	82. 2	17. 8
1951	7, 742	6, 350	82. 0	18. 0
1952	8, 821	6, 120	69. 4	30. 6
1953	9, 820	----------	----------	----------

[1] Estimated by assuming that the percentage calf crop *by States* is the same for milk and beef cows, and that 50 percent of calves are heifers. This slightly overestimates the beef heifer crop. These are not official estimates.

TABLE 4.—*Distribution of inventory of cows and heifers, 1944–54*

Year	Supply						Disappearance						
	On hand January 1				Imports [2]	Total less heifers on feed	Estimated death losses [3]	Cows on hand following Jan. 1	Apparent slaughter of cows [4]		Estimated actual slaughter of cows [5]		Discrepancy [6]
	Milk and beef cows	Heifers 1–2 years (Milk and beef)											
		Total	Estimated number on feed [1]	Other than on feed					Number	Percentage of supply	Number	Percentage of supply	
	1,000 head	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*	*Percent*	*1,000 head*	*Percent*	*1,000 head*
1944	43, 225	11, 323	625	10, 698	50	53, 973	1, 100	44, 226	8, 647	16. 0	8, 275	15. 3	372
1945	44, 226	11, 376	675	10, 701	66	54, 993	1, 050	42, 929	11, 014	20. 0	8, 482	15. 4	2, 532
1946	42, 929	10, 617	660	9, 957	108	52, 994	1, 000	42, 330	9, 664	18. 2	7, 493	14. 1	2, 171
1947	42, 330	10, 160	675	9, 485	74	51, 889	940	40, 625	10, 324	19. 9	8, 693	16. 8	1, 631
1948	40, 625	10, 068	625	9, 443	127	50, 195	900	39, 781	9, 514	19. 0	7, 786	15. 5	1, 728
1949	39, 781	9, 984	885	9, 099	70	48, 950	960	40, 596	7, 394	15. 1	5, 930	12. 1	1, 464
1950	40, 596	10, 148	645	9, 503	69	50, 168	930	42, 118	7, 120	14. 2	6, 071	12. 1	1, 049
1951	42, 118	10, 592	650	9, 942	55	52, 115	970	43, 959	7, 186	13. 8	5, 763	11. 1	1, 423
1952	43, 959	11, 600	830	10, 770	9	54, 738	1, 000	46, 584	7, 154	13. 1	5, 806	10. 6	1, 348
1953	46, 584	12, 324	990	11, 334	43	57, 961	970	48, 490	8, 501	14. 7	7, 784	13. 4	717
1954	48, 490	12, 152	835	11, 317	------	--------	-------	--------	--------	------	-------	------	------

[1] Estimated from available data.
[2] Imports of "breeding cattle" and of "cows for dairy purposes."
[3] Estimated on basis of cattle inventories.
[4] By subtraction.
[5] Estimated on assumption that cows are the same percentage of noninspected cattle slaughter as of inspected slaughter. In reality they are a higher percentage. Hence, these are underestimates.
[6] Difference between apparent and estimated slaughter. Partly attributed to estimating error named in note 5.

all other heifers are considered as destined to enter the cow herd and are included in the beginning inventory data of the table.

For all three tables some rather arbitrary estimates had to be made. The division of the total calf crop into milk and beef calves is only approximate. Very rough guides were followed in apportioning total death loss of cattle into individual classes. But the data do illustrate the potential value of this approach.

Primary worth of the progressive balance sheet technique is that it helps to isolate points of decision in managing the cattle herd. These are more susceptible to economic analysis than are the grand totals of cattle production. For instance, what factors control the decision to save few or many milk heifer calves (table 2), or beef heifer calves (table 3)? What influences the slaughter rate for cows (table 4)?

Anatomy of the Cycle

The typical cattle cycle can be dissected in another way that aids analysis. As each cycle evolves, a number of changed relationships within the cattle industry appear. These are amenable to study, and they facilitate prediction. Changes in these particular relationships in the progress of each cycle can be foreseen more accurately than its overall dimensions.

Table 5 and figures 3, 4, and 5 provide data on the structural composition of the January 1 inventory and of annual slaughter, and on price levels and price relationships at successive stages of the cycle. The uniformity between cycles is far from perfect, and it looks less perfect than it is because the varying lengths of cycles partly hide similarities. But uniformity is close enough to be informative.

TABLE 5.—*Selected examples of changing relationships in the cattle cycle: Data for past cycles tabulated by years in inventory cycle*

Year in inventory cycle	Composition of inventories											
	Cows as a percentage of all cattle and calves				Heifers as a percentage of all cattle and calves				Calves as a percentage of all cattle and calves			
	1912–28	1928–38	1938–49	1949	1912–28	1928–38	1938–49	1949	1912–28	1928–38	1938–49	1949
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1	-------	54. 4	53. 0	51. 8	-------	11. 8	12. 2	13. 0	-------	21. 9	23. 8	23. 6
2	-------	53. 4	52. 4	52. 1	-------	12. 2	12. 4	13. 0	-------	22. 5	24. 9	24. 0
3	-------	52. 8	52. 1	51. 3	-------	12. 5	13. 0	12. 9	-------	23. 1	24. 8	25. 2
4	-------	53. 3	51. 3	50. 0	-------	12. 7	13. 2	13. 2	-------	22. 4	24. 6	25. 3
5	-------	53. 7	51. 1	49. 7	-------	12. 4	13. 1	13. 2	-------	23. 1	24. 8	25. 4
6	-------	53. 0	50. 6	51. 2	-------	12. 3	13. 1	12. 8	-------	24. 1	25. 0	25. 4
7	-------	53. 3	50. 6	-------	-------	12. 1	13. 3	-------	-------	24. 1	24. 6	-------
8	-------	54. 1	51. 7	-------	-------	12. 2	13. 3	-------	-------	23. 6	23. 0	-------
9	-------	53. 4	52. 2	-------	-------	12. 2	12. 9	-------	-------	23. 7	23. 3	-------
10	-------	53. 5	52. 6	-------	-------	12. 3	12. 6	-------	-------	23. 7	23. 7	-------
11	-------	53. 0	52. 6	-------	-------	12. 2	13. 0	-------	-------	23. 8	23. 4	-------
12	-------	-------	51. 8	-------	-------	-------	13. 0	-------	-------	-------	23. 6	-------

Year in inventory cycle	Composition of slaughter											
	Cows and heifers as a percentage of all cattle slaughtered [1]				Steers as a percentage of all cattle slaughtered [1]				Calves as a percentage of all cattle and calves slaughtered			
1	-------	50. 7	49. 8	42. 9	-------	45. 4	46. 2	53. 6	33. 8	38. 9	38. 6	37. 8
2	-------	47. 4	47. 1	43. 2	-------	48. 6	48. 6	53. 0	32. 8	38. 1	38. 6	36. 1
3	-------	44. 3	45. 9	43. 8	-------	51. 9	49. 9	52. 0	31. 9	39. 2	37. 8	34. 3
4	-------	41. 7	45. 6	41. 8	-------	54. 8	49. 9	54. 5	31. 9	40. 0	36. 0	33. 5
5	-------	41. 9	47. 4	43. 3	-------	54. 5	48. 7	53. 6	32. 5	39. 9	35. 0	33. 3
6	-------	44. 0	47. 0	-------	-------	52. 1	48. 9	-------	31. 9	39. 5	35. 8	-------
7	-------	48. 7	52. 9	-------	-------	47. 9	42. 0	-------	30. 5	37. 6	31. 8	-------
8	53. 4	56. 0	50. 3	-------	43. 5	39. 9	45. 8	-------	35. 3	39. 4	38. 6	-------
9	47. 4	52. 2	49. 4	-------	49. 4	43. 7	47. 0	-------	38. 6	38. 6	38. 0	-------
10	42. 3	55. 9	51. 4	-------	54. 0	40. 1	44. 9	-------	40. 1	40. 3	38. 0	-------
11	44. 0	49. 8	52. 0	-------	52. 2	46. 2	44. 3	-------	39. 2	38. 6	39. 2	-------
12	47. 9	-------	42. 9	-------	48. 0	-------	53. 6	-------	39. 5	-------	37. 8	-------
13	49. 4	-------	-------	-------	46. 5	-------	-------	-------	39. 9	-------	-------	-------
14	50. 4	-------	-------	-------	46. 0	-------	-------	-------	40. 3	-------	-------	-------
15	49. 7	-------	-------	-------	46. 8	-------	-------	-------	38. 8	-------	-------	-------
16	49. 2	-------	-------	-------	47. 1	-------	-------	-------	38. 7	-------	-------	-------
17	50. 7	-------	-------	-------	45. 4	-------	-------	-------	38. 9	-------	-------	-------

Year in inventory cycle	Price ratios											
	Utility slaughter cows to Choice slaughter steers at Chicago				Utility slaughter steers to Choice slaughter steers at Chicago				Feeder steers at Kansas City to Choice slaughter steers at Chicago [2]			
1	-------	55. 0	62. 3	62. 6	-------	74. 7	74. 1	75. 8	-------	78. 3	82. 5	81. 9
2	-------	55. 6	61. 1	65. 2	-------	77. 1	76. 6	77. 0	-------	75. 2	82. 5	89. 9
3	-------	50. 0	55. 9	68. 1	-------	76. 3	71. 7	78. 7	-------	71. 4	81. 4	90. 7
4	-------	44. 5	61. 6	58. 9	-------	69. 6	76. 1	68. 4	-------	68. 3	87. 4	77. 0
5	-------	39. 7	61. 4	51. 4	-------	69. 0	74. 8	65. 3	-------	67. 5	84. 5	71. 9
6	-------	48. 6	68. 7	-------	-------	73. 4	76. 0	-------	-------	74. 5	80. 5	-------
7	-------	42. 4	64. 0	-------	-------	61. 8	71. 5	-------	-------	58. 6	74. 9	-------
8	-------	47. 8	69. 8	-------	-------	62. 4	73. 3	-------	-------	63. 8	81. 7	-------
9	-------	56. 1	61. 7	-------	-------	74. 6	71. 2	-------	-------	72. 4	82. 1	-------
10	-------	49. 9	54. 4	-------	-------	63. 7	68. 8	-------	-------	65. 5	79. 4	-------
11	-------	62. 3	62. 9	-------	-------	74. 1	71. 6	-------	-------	82. 5	82. 5	-------
12	-------	-------	62. 6	-------	-------	-------	75. 8	-------	-------	-------	81. 9	-------

See footnotes at end of table.

TABLE 5.—*Selected examples of changing relationships in the cattle cycle: Data for past cycles tabulated by years in inventory cycle*—Continued

Year in inventory cycle	Price levels											
	Price per 100 pounds of beef steers, all grades, at Chicago, deflated				Prices received by farmers for beef cattle as a percentage of parity [3]				Value per head of cattle on farms Jan. 1, deflated			
	1912–28	1928–38	1938–49	1949	1912–28	1928–38	1938–49	1949	1912–28	1928–38	1938–49	1949
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Percent*	*Percent*	*Percent*	*Percent*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1	7. 67	9. 87	8. 17	11. 57	99	105	96	152	28. 70	36. 00	31. 00	58. 50
2	8. 09	9. 66	8. 63	12. 65	112	106	107	169	32. 20	41. 80	34. 20	56. 50
3	8. 74	8. 69	9. 07	13. 84	118	91	111	193	38. 90	41. 80	35. 00	61. 90
4	8. 32	7. 53	8. 92	12. 90	108	73	123	163	40. 90	34. 10	36. 60	70. 50
5	7. 60	7. 05	9. 58	9. 56	100	64	132	110	35. 70	26. 90	39. 30	51. 90
6	6. 74	5. 65	10. 20	-------	106	58	139	-------	29. 10	22. 20	46. 60	37. 10
7	7. 67	6. 20	10. 16	-------	105	59	121	-------	27. 40	16. 90	45. 40	-------
8	7. 67	8. 77	10. 51	-------	95	89	132	-------	27. 80	17. 60	43. 70	-------
9	5. 88	7. 47	10. 82	-------	80	86	139	-------	22. 90	28. 90	48. 70	-------
10	5. 73	9. 10	11. 96	-------	64	98	148	-------	23. 50	27. 20	47. 00	-------
11	6. 13	8. 17	13. 20	-------	64	96	167	-------	22. 80	31. 00	49. 80	-------
12	6. 39	-------	11. 57	-------	65	-------	152	-------	21. 30	-------	58. 50	-------
13	6. 46	-------	-------	-------	65	-------	-------	-------	22. 10	-------	-------	-------
14	6. 73	-------	-------	-------	71	-------	-------	-------	21. 10	-------	-------	-------
15	6. 49	-------	-------	-------	75	-------	-------	-------	24. 40	-------	-------	-------
16	8. 17	-------	-------	-------	85	-------	-------	-------	28. 40	-------	-------	-------
17	9. 87	-------	-------	-------	105	-------	-------	-------	36. 00	-------	-------	-------

[1] Under Federal inspection.
[2] Feeder prices are average for all weights and grades of stocker and feeder steers.
[3] Parity as computed by the "old" formula in use prior to 1950.

INVENTORIES.—An increase in the number of cattle on farms is inaugurated by holding cattle longer. This is true for all classes, not breeding stock alone as is sometimes supposed. Slaughter stock are held only a little longer, then are sold. Calves, on the other hand, are held much longer. Accordingly, calves early become an increasing percentage of the total inventory of cattle. Their lowest percentage commonly comes before the low point in total cattle numbers, and the proportion of calves in inventories climbs rather steeply in early years of expansion (table 5). The proportion of cows is much slower to increase; it does so only after the heifer calves that were held back reach calving age. In the present cycle, the percentage of cows increased in January 1954. Cow numbers stay high through much of the liquidation phase of the cycle. Cows are the foundation of the herd; hard-pressed cattle producers hold on to them longest. The first stages of slowdown and then reduction are marked by selling slaughter stock at younger age and reducing their proportion in inventories, not by a quick drop in the proportion of cows.

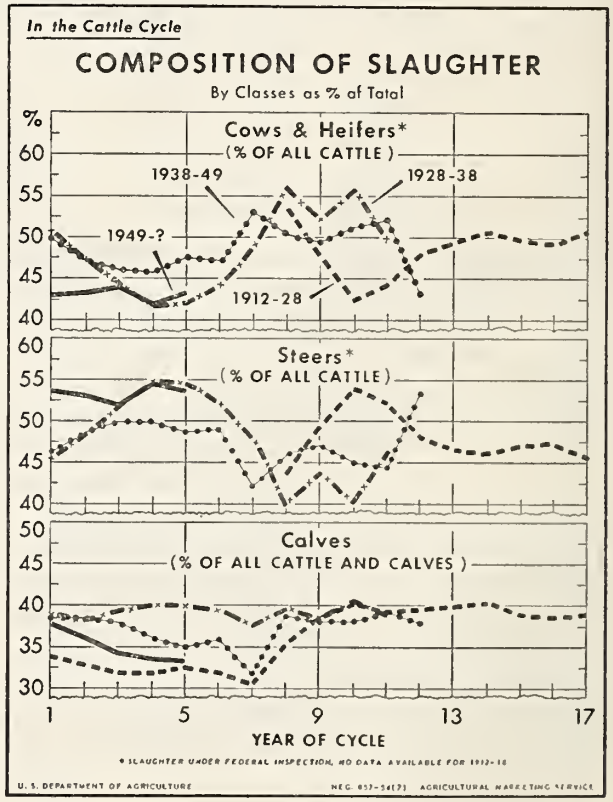

FIGURE 3.

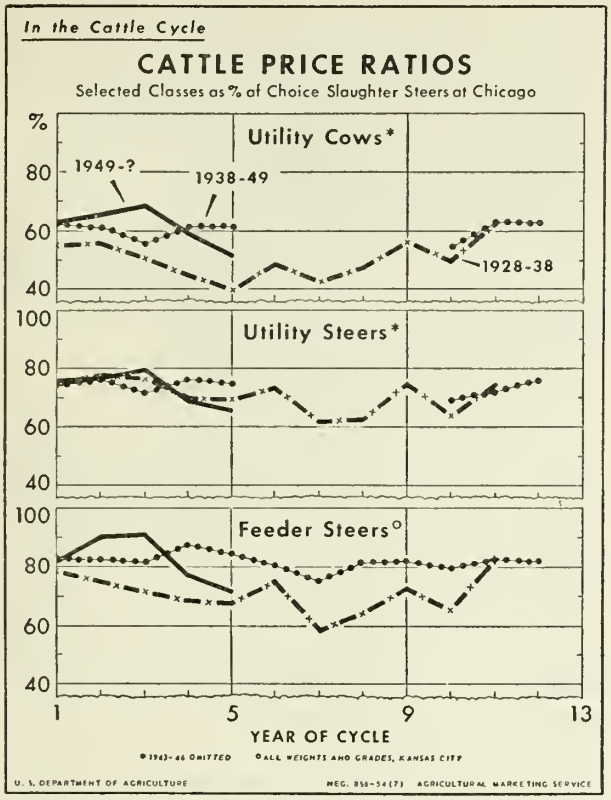

FIGURE 4.

SLAUGHTER.—Typical cyclical trends in slaughter of the various classes conform to these trends in inventories. The percentage of calves in the total slaughter of cattle and calves decreased at the final stage in the last 3 cycles (figure 3). In 3 of the 4 cycles it continued downward until about the time the peak in the inventory cycle was reached. Only in 1928–38 was this pattern different. The disposition of calves is the controlling factor in cyclical changes in cattle numbers.

Slaughter of cows and heifers is a low proportion of total cattle slaughter in early stages of the cycle and a higher proportion later. Slaughter of steers has the opposite character, rising to a high just before the midpoint in the total cycle. When cattle numbers are being expanded most rapidly, slaughter steers are the class that producers are most willing to release to slaughter. Steers then form a high percentage of all slaughter. In keeping with the typical behavior, during 1954 the percentage of cows and heifers in slaughter was sharply increased and the percentage of steers was decreased. These new proportions will continue in the next year or longer.

PRICE RATIOS.—Prices for cattle naturally take on a cyclical pattern. Cyclical change is evident for both the level of cattle prices and for relationships between prices of different kinds of cattle, but it is more consistently revealed in the latter.

When interest in expansion begins, confidence is high and demand is strong for the classes needed to conduct the expansion. These are replacement stock in general and cows and heifers in particular. Thus we find that the ratio of prices of cows to prices of slaughter steers turns upward before the low point in inventories is reached, and it is high in the first years of expansion. This ratio typically declines in advance of the peak of the numbers cycle. In 1951, for instance, Utility cows at Chicago sold for only 32 percent less than the prices of Choice steers. In 1953 they were 49 percent less. (These ratios are shown in the upper section of figure 4.) Ratios in the present cycle are probably following a path that may be regarded as more normal than those in previous

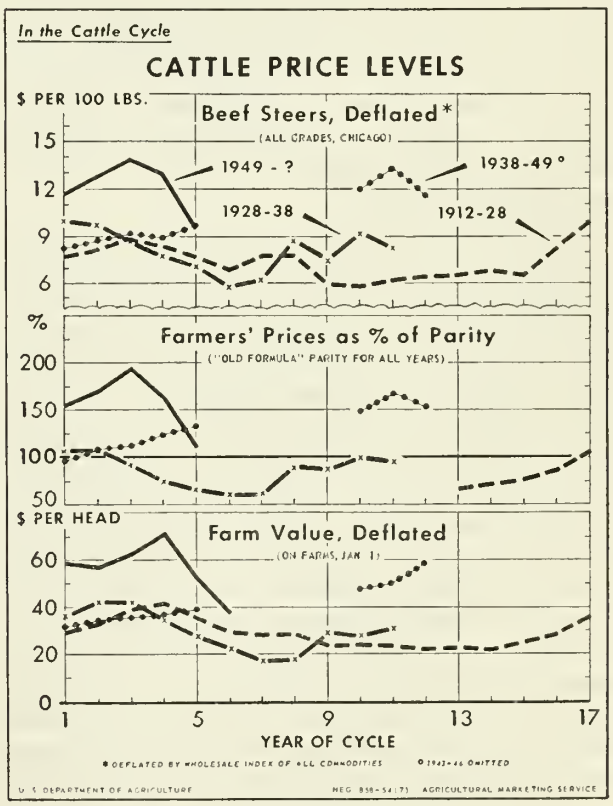

FIGURE 5.

cycles. The depression interfered with normal relationships in 1928–38 and the defense and war periods did the same in the 1938–49 cycle.

Prices of feeder cattle also tend to be high in the first stages of a cycle. They are high because there is confidence that prices for fed cattle will be high when the cattle are sold; and because prices of fed cattle at that stage are so high relative to prices of feed that only a narrow margin between the buying and selling prices per pound for the feeder animals is necessary. When prices of fed cattle decline, prices of feeder cattle drop more and the feeder-fat cattle price ratio is lowered. This too happened in 1953. (See table 5 and figure 4).

Similarly, when expansion slows, prices of slaughter cattle of the lower grades are depressed more than those of higher grades. Steers sold off grass become low priced relative to grain-fed steers. These trends are outlined in the center section of figure 4. Lower grade cattle suffer the sharper decline (1) in sympathy with the declines for feeder stock; (2) in response to a greater increase in their supply than in the supply of cattle of higher grades, while the slaughter demand for them is more likely to diminish than to strengthen; and (3) as a result of the greater selectiveness shown by buyers when cattle are plentiful than when they are scarce. Prices of all lower grade cattle suffered severe price declines in 1952–53. They will remain in a reduced ratio to prices of cattle of the higher grades, although the spread was narrowed in 1954.

Price Levels.—Finally, cyclical tendencies are exhibited in levels of cattle prices. Actual prices in dollars conform only roughly to cycles because they reflect not only the supply of cattle but also the general level of all commodity prices. To produce cyclical curves of some regularity it is necessary to deflate the reported prices. This was done in the data of table 5 and figure 5. Deflation for steer prices and farm value was by the general wholesale price index. For the average prices received by farmers it was by the parity index ("old" formula). Deflated prices are seen to reveal a cyclical elevation at the beginning of an inventory cycle and a decline later. Prices received by farmers have greater ups and downs than prices for slaughter steers. This is true because farmers' prices include prices for replacement cattle, which have exaggerated swings of their own.

Prices of slaughter steers bear the closest relation to the price-making factors of supply of and demand for beef. Average prices for all cattle, which include the sharply fluctuating prices of replacement stock, are less closely connected.

Incidentally, the necessity for deflating reported prices before sketching cyclical patterns is a basis for regarding the cattle cycle as not entirely self-generated. Lorie correctly points out that the cycle can be explained as impelled by prices of cattle only if those prices are themselves determined by forces in the cycle (*6*).

Application to Forecasting

The foreging exposition should make possible more productive analyses of trends in cattle and should improve the accuracy of forecasts. Critical points have been suggested at which hypotheses could be developed and analysis applied. For example, it was noted that "the disposition of calves is the controlling factor in cyclical changes in cattle numbers." The 10 percent increase in calf slaughter in 1954 is more informative as to prospective future trends than is the 14 percent increase in cow slaughter.

Still lacking are techniques for bringing outside factors more accurately to bear on cattle trends. How can the effect of the size of feed supply (including range and pasture feed) be statistically measured? How much influence is wrought by a change in attractiveness of other livestock enterprises? These are only samples of questions that still need answering to solve the perplexing riddle of the cattle cycle—a cycle ranking high in regularity and magnitude among all cycles of our modern economy.

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Sampling in West German Official Agricultural Statistics

By Heinrich Strecker

Translation by Walter A. Hendricks

This paper, which summarizes developments in the theory and practice of agricultural statistics in West Germany during the last 6 years, is reproduced here in an English version for the first time in an American journal. It was given at the 24th Annual Meeting of the German Statistical Association in October 1953, and published by the journal of that organization.[1] *The translator, Mr. Hendricks, and Paul L. Koenig, also of the Agricultural Estimates Division, worked with the Food and Agricultural Offices of the Bipartite Control Commission in Germany in the summer of 1948. At that time they took part in some of the early work mentioned by Dr. Strecker.*

SAMPLING is particularly fruitful in agricultural statistics. Factors that recommend the use of sampling here are the same as those in other areas of official statistics (*1, 3, 4*). An additional important reason for using sampling methods in agricultural statistics is the reduction of heavy workloads in the Government agencies that conduct surveys.

In the German Republic, official agricultural statistics for the last several years has been concerned with efforts to convert one-time censuses and large-scale current enumerations to a sample-survey basis as far as possible, or with the use of sampling to derive preliminary estimated totals from complete enumerations. This is particularly true for determinations of crop production, livestock enumerations, statistics on milk production, and farm labor-force enumerations.

In land-use censuses, the first studies to date on the possibility of substituting sample surveys for complete enumerations are being started. These should measure any bias that may be present in current complete enumerations and thus improve the results. So far as one can see today, practically all techniques developed in the theory of sampling are applicable. For individual agricultural surveys, the particular methods that are most appropriate become apparent.

The examples that follow indicate the present status of sampling in agricultural statistics; they also illustrate typical sampling methods used in agricultural statistics.

[1] ALLGEMEINES STATISTISCHES ARCHIV (Organ der Deutschen Statistischen Gesellschaft) 38: 17–27. 1954.

Objective Crop Yield Determinations

Sampling in official agricultural statistics in Germany began with an "objective yield determination," introduced in 1948 with the assistance of W. A. Hendricks and Paul Koenig, both of the U. S. A. It served—along with the estimates of crop reporters—to establish average yields per hectare of winter rye, winter wheat, and late potatoes. Recently, summer barley was included in Bavaria, Baden-Württemberg, and Rheinland-Pfalz.

Shortly before harvest, so-called harvest teams visit sample fields selected by the principle of probability (lot) and take small sample cuttings (or diggings). To reduce costs of travel, a multistage sample design is employed (*2*). This consists of drawing the sample in a number of stages, the randomly selected units becoming smaller at each stage. The sampling units at each stage are:

Village	=Stage 1.
Farm	=Stage 2.
Field	=Stage 3.
Crop sample	=Stage 4.

To make proper allowance for differences in plantings of grain and potatoes in the individual counties and States, a specified number of villages (stage 1) is selected at random within counties, by the cumulative method. The number of villages per State varies from State to State. The total number of villages selected in the whole country is approximately 1,300, which is a little more than 5 percent of all villages. Thereafter, maintaining the proper proportions of large and small farms, two farms (stage 2) are selected at random in each

selected village. On each of these in turn a field (stage 3; selection by lot as for stage 2) is taken for determination of yield.

For each of the grains sampled five sample cuttings of a square meter each are taken according to specific instructions. The technical instrument used for this is a square-meter frame. It consists of four iron bars each 1 meter long, three of which are tightly joined together at right angles. The fourth is pushed in only after the frame is in position at the sample spot.

For potatoes, five sample diggings, representing an area of about 25 square meters, are taken on the randomly selected fields. Sample cuttings and sample diggings measure only yields actually on the plants. No allowance is made for harvesting losses that occur under normal farm harvesting conditions (cutting, drying, transporting to shed, storage, and threshing in the case of grain). Therefore, a subsample of at least 15 percent of the sampled fields (subsampling) is selected for complete threshing or complete digging.

By pairing yields obtained from complete harvesting and from the small samples, we obtain the correct relationship between yields under farm harvesting conditions and those computed from exact measurements and weights in small samples. The numerical expression of this relationship is called a correction factor.

In Bavaria, for example, the yield of winter rye for the 1953 harvest, as computed from small samples in 500 sample fields, was 24.2 dz/ha. On 78 of these fields complete threshing data showed a yield of 23.4 dz/ha. The indicated yield from the small samples in these fields was 24.6 dz/ha. Thus the correction factor is $23.4/24.6=0.95$. Multiplying the small-sample yield computed from all 500 fields by this correction factor gives the actual yield $24.2 \times 0.95=23.0$ dz/ha. These objective estimates (from small cuttings and complete threshings) are free of bias, despite the small size of the unit used for cutting—1 square meter.

Translator's Note: The expression dz/ha means "double-zentner per hectare." The double-zentner is equivalent to nearly 200 pounds (1.967 cwt.). Hectare is a land measure roughly equivalent to 2.5 acres (2.471). Hence, 1 dz/ha is just about equal to 80 pounds of product to the acre (79.6). For wheat (with 60-lb. bushels) a dz/ha, therefore, would convert to 1.33 bushels per acre; for barley (with 48-lb. bushels) to 1.67 bushels per acre, and so on.

By comparing yields estimated from small cuttings with those from complete threshings, P. V. Sukhatme in India, and F. Yates in England, showed that estimates of yield tend to be progressively higher as the units used for cutting are made smaller. Sukhatme (*12*) conducted his studies (in Moradabad, 1944–45) mainly on wheat. For convenience the sampling units used were equilateral triangles and circles of various sizes.

Translator's Note: Here Dr. Strecker reproduces a table from Sukhatme's paper. As it is readily available in this country, it is not repeated here.

The results show that small sampling units lead to heavy overestimates of yield and that the overestimation becomes progressively smaller as the sampling units become larger. The relative proportion of plants on the perimeter is greater in small sampling units than in larger ones. It is evident that with small sampling units the inclusion of a few too many plants on the perimeter will have greater influence on results than would be true with larger units. Results of the studies show further that yield estimates are influenced more by size of units than by their shape, although a circular unit is preferable because its perimeter is smallest in relation to area. In Germany large sampling units are not contemplated. Damage to individual fields would be too great. Therefore, correction for complete threshing must be made to adjust data from small samples.

Translator's Note: In discussing the bias that sometimes occurs with small samples, Dr. Strecker is here repeating explanations that have been offered by Sukhatme and others. But many statisticians believe, with good reason, that much of the bias results from selection of better parts of the fields in locating sampling units rather than from a "border effect." Furthermore, some of the discrepancy between yield estimates from small samples and complete harvestings is explainable by normal harvesting losses under farm operating conditions.

The Farm Enumeration of 1949

Preliminary tabulations of data from the agricultural census of May 22, 1949, were made from samples (*7*, *10*) in Bavaria to learn how closely results from a sample would approximate those from complete enumeration. It was also intended to show which items now obtained on complete enumerations would be most amenable to sample surveys. For these preliminary tabulations

stratified sampling [2] was adopted as the most efficient.

Stratified sampling achieves its particular advantages over simple sampling by sorting heterogeneous statistical material into homogeneous strata so that the large differences are between strata. As items used for stratification must be correlated with items to be estimated, size of farm was used to delineate strata for the preliminary tabulation.

The following three strata were set up:

Stratum I: Farms of from 0.5 to less than 50 ha.
Stratum II: Farms of from 50 to less than 200 ha.
Stratum III: Farms of 200 ha and over.

After stratifying the questionnaires by county and by size of farm within counties, every 50th was selected from stratum I, and every 10th from stratum II.[3] All of stratum III was tabulated. Thus in Bavaria about 12,000 questionnaires, or a bit more than 2 percent of the approximately 504,000 in the universe, were selected. Results on individual items show that the sample estimates were satisfactorily accurate. For nearly half the items the differences between sample estimates and totals from complete tabulations were less than 1 percent; for four-fifths, less than 5 percent; and for nine-tenths, less than 10 percent.

Enumeration of the Family Labor Force

Previously, trends in numbers of farm operators and family coworkers could be observed only from farm enumerations that are taken at long intervals. For current observation of the family labor force, and to provide a basis for employment statistics such as wage rate and social-political data, it is important to have at hand semiannual figures on the farm family labor force. To save costs and time, and especially to lighten the work of village officials, these enumerations have been made by sampling since April 1952. It was required that for each of the major categories (farm operators and family workers by sex and age) the sampling error limits [4] should not exceed ±2 percent for each State and that the sample size for the entire country should not exceed 8 percent of all farms present (*13*).

Because a list of names and addresses for all farms in the universe was available, a stratified sample was chosen as the most efficient for this survey. Size of farm was used as the criterion for stratification. Altogether, six strata (farm size groups) were set up. The selection of farms from these strata in each State, for which different sampling rates were specified, was made from 1949 farm census data (farms of 0.5 ha and over) and from the 1950 market garden census (only market gardens of less than 0.5 ha because all large truck farms of 0.5 ha or more were included in the farm census).

For operational reasons a systematic selection procedure was again employed. For the entire country the classification of farms by strata is as follows:

Strata	Number of farms in sample	Sample size as percent of universe
I. 0.01 to less than 5 ha of farmland	77, 600	6. 5
II. 5 to less than 10 ha of farmland	37, 100	9. 2
III. 10 to less than 20 ha of farmland	25, 900	10. 2
IV. 20 to less than 50 ha of farmland	12, 700	11. 3
V. 50 ha of farmland and over	3, 500	22. 2
VI. Market gardens less than 0.5 ha	1, 100	20. 0
Total	157, 900	8. 0

Thus the total sample amounted to about 158,000 farms, or 8 percent of the total universe. After straightening out some small difficulties with the exact wording and arrangement of questions (with respect to farm operators and their family labor force) the results now come fully up to expectations.

Livestock Enumerations

As with all current agricultural enumerations, the general livestock census in December, the addi-

[2] See, for example, Deming, W. E., loc. cit., p. 213.

[3] As it is difficult to select a large number of farms entirely at random, systematic sampling is more popularly used in practice. In large surveys like farm enumerations, systematic samples can be regarded as the equivalent of genuine random samples without committing appreciable error (*5*).

[4] Sampling error limits=twice the standard error.

tional midyear livestock census in June, and the two semiannual pig censuses in March and September place a considerable workload upon the villages just as does the May land use census. Hence, it is planned first to put the semiannual pig enumerations, and later also other livestock enumerations, on a sample survey basis as might be done for the land use census. In pig enumerations it is required that the sampling error limits (two times the standard error) in any State shall not exceed ±2 percent for all pigs nor ±3 percent for any category of breeding sows.[5]

In no area of official statistics up to this time was the introduction of sample surveys preceded by so much preparatory work as for the semiannual pig enumerations. Much was learned about the efficiencies of different methods. The principal results are given here in some detail.

The first question that arose in planning such a sample survey was whether the sampling unit should be the village or the hog-farm operator. As a sample survey using the village as sampling unit is easier to carry out administratively than one using the hog-farm operator, studies were first conducted with the village as the sampling unit. A sample survey enumeration by villages, moreover, has the advantage that from one enumeration to another the unit remains a fixed administrative unit—the village—which is not subject to abrupt changes like the hog-farm unit. Proper allowance is made here for new hog-producing farms from one survey to the next.

Less preparatory work is required for a survey that uses the village as the unit than for one that uses the hog farm as the unit. But difficulties arise in the practical operation of a sample survey by villages, because of differences in the size of the pig population from one village to another (clustering). The larger and more variable such clusters are, the greater the error in the estimates. Pig numbers in individual clusters (villages) varied, for example, from 10 to 2,500 in the September 1952 census in Bavaria.

[5] At the beginning of this year the Ministry for Nutrition, Agriculture, and Forestry of the Republic established new error limits. It was desired that limits not exceed ±3 percent for total breeding sows in any State nor ±2 to ±3 percent for total pigs (Bavaria and Lower Saxony ±2 percent, North-Rhine Westphalia ±2.3 percent, all other States ±3 percent).

As past studies (*11*) on a sample with the village as sampling unit have shown, it is not possible even by applying refined methods, to reach a double standard error of the order of magnitude of 3 percent on prospective pig numbers by subclasses of breeding sows. This is due mainly to the heterogeneous composition of pig populations within individual villages, which causes standard errors computed from variability to be large for individual estimates.

One of the refined methods used consisted of a stratification of villages on the basis of pig numbers with a simple estimating procedure based on the sampling rate; another consisted of basing computations upon a ratio estimate (*6*), by utilizing data from a previous complete enumeration. As a relatively high correlation exists between sample counts and census data for almost all sex and age groups, appreciable improvement was obtained by using ratio estimates instead of a simple expansion.

But the improvement was not enough to attain the required degree of precision by subclasses of breeding sows. Therefore, studies were conducted with the hog farm as the sampling unit. Estimates were again made by both the simple and the ratio methods. To increase the efficiency of such a sample with the hog farm as the sampling unit and to make proper allowance for the heterogeneity of the universe, use was again made of stratification. The pig enumeration of December 2, 1950, was used to set up the following strata:

Stratum I: All hog farms having one or more breeding sows on December 2, 1950.

Stratum II: All hog farms having no breeding sows on December 2, 1950.

Results of this study showed that a sample pig enumeration, having the desired accuracy by subclasses of breeding sows, is feasible when hog farms are used as sampling units. Only the simple estimating procedure can be used because correlation between pig numbers from two enumerations is relatively small in individual class intervals. Low correlation appears because, for example, breeding sows which are pregnant in December are no longer pregnant at the time of the survey—March—and therefore shift from one category to another. Because narrow class intervals are used for age grouping in the census, a heavy shifting takes place in those groups. Therefore, the coefficient of correlation must be much lower in contrast

to its value when villages are used as sampling units.

In accordance with these results, the pig enumeration was carried out by sampling for the first time in March 1952, with hog farms as sampling units. To increase the efficiency of the sample, stratum III, consisting of "large hog farms" with 50 or more pigs, with or without breeding sows, was added and was enumerated completely. For the country as a whole 6 percent of the hog farms—120,000 farms—were included in the sample.

Sampling rates in individual strata varied from State to State. To take account of new hog farms that had appeared since the most recent census, a special survey was conducted in 10 percent of the villages where all pigs were enumerated on hog farms that had appeared since the previous census. Estimates (*9*) from this first sample survey were within the required error limits for the country as a whole. But it was apparent that the results were not strictly comparable with previous and later census data because inherent bias caused by differences in quality of enumerators is different from that in a sample survey. In a partial enumeration, only a few, but careful, enumerators are employed. Because of the lack of comparability, the sampling method was not applied again in the September 1952 pig enumeration despite the high degree of confidence in the above results.

In 1952–53 the main effort was devoted to improving the sample with regard to comparability. If randomly selected localities were chosen for enumeration (area sampling), comparability could doubtless be improved. If sizes of areas that are too large were decreased, and sizes of those that are too small were increased, a further improvement in the survey would result. In March 1954 it is planned to apply, for the first time in official German statistics, the area-sampling procedure that is used so successfully outside the country, particularly in the United States. Area sampling consists of subdividing the entire geographic area that covers the universe of inquiry into small area segments (sampling units).

For this purpose, in July–September 1953 the total area of all villages in the entire country was subdivided into such "area segments." An "area segment" is here defined as an area that contains from 15 to 25 hog-farm operators. Clusters of about equal size thus serve as sampling units. They are more efficient than clusters of unequal size. Enumerators do their work in these segments just as in their previous enumeration districts. But conducting a survey by area sampling is possible only when every area segment in a village is delineated exactly and these units remain constant in every survey.

To make proper allowance for numbers of breeding sows, which are of particular importance in estimating prospective pig numbers, and to make the survey more efficient, use is again made of stratification. For Bavaria it is as follows:

Stratum I: Area segments with 0 to 7 breeding sows.
Stratum II: Area segments with 8 to 25 breeding sows.
Stratum III: Area segments with 26 and more breeding sows.

Class intervals and sampling rates for individual strata are different from State to State. In the Federal Statistics Office, and in the State Statistics Offices of North Rhine-Westphalia and Bavaria, sampling studies were made on data from the pig enumerations of September 3, 1953. The sample estimates made were within the required limits of error. The sample for the entire country will amount to about 8 to 10 percent of all area segments in the universe.

Statistics on Fruit Yield and Milk Production

Sampling is used in German official agricultural statistics not only to reduce the workload of State and village officials and to reduce costs, but also to improve data resting on judgment appraisals. Statistics on the fruit crop and on milk production and utilization are based on judgment appraisals, because objective sampling procedures, although possible in theory, are difficult to apply in practice. To find a workable way of eliminating the effects of subjectivity, with which these judgment appraisals are encumbered, cooperative studies on objective measurement surveys were made by the Federal Statistics Office and the State Statistics Offices of Baden-Württemberg, Lower Saxony, and Bavaria.

In the future, it is planned to estimate the fruit crop, parallel to current fruit estimating procedures, by a multistage sample survey (*14*) similar to that used in objective crop-yield surveys. For this purpose, villages will need to be selected at random in each State in which harvested fruit weights are taken from randomly selected trees.

In the crop year 1951–52, studies were set up in the Bavarian State Statistics Office with the help of ERP funds to estimate monthly milk production on farms in Bavaria by sample surveys. The project was a stratified sample survey, the sampling units being farms that had cows. All farms with cows on the list from the 1949 farm census were divided into three strata:

Stratum I: Cow farms of size 0–50 ha.
Stratum II: Cow farms of size 50–150 ha.
Stratum III: Cow farms of size 150 ha and over.

In total, from a universe of about 500,000 farms with cows, 11,100 were reached monthly by mail, but only 5,600 gave information on milk production for their farms. To estimate milk production the monthly production for the farm was not asked, but instead the production for 1 day of the month (sample day). As it may be assumed that reported production for a single day is more accurate and that this report imposes less strain on the farm operator, the sample day was used in these surveys.

To make allowance for effects of weather and feeding and for other such short-time variations in milk production, the production on the sample farms was not asked for the same day of the month in question. Instead the farms in each size group were classified into six groups of equal size and were allocated uniformly over the State. Each of these groups was asked to report on milk production for a different sample day in the month. The monthly milk production was computed by multiplying the average daily production by the number of days in the month.

Determination of Errors in the Land Use and Livestock Censuses

In agricultural statistics sample surveys are used not only to reduce costs, time, and labor by substituting them for complete village enumerations, but also to ascertain the errors in current large-scale enumerations. Thus sample spot checks are made regularly on the accuracy of land-use data reported by farmers in the land-use censuses and of livestock numbers reported in the livestock enumerations. This is done by experts, but never by persons directly connected with the complete enumeration.

As travel costs of experts are considerable, checks are generally made according to a two-stage sample design. The two sampling stages are village and farm. As the error is conveniently expressed in percentage terms, the ratio, sample check/census report, is computed for each farm that is checked. From these ratios an average ratio, f, and a ratio estimate are computed. The average ratio indicates whether the data reported by farmers in the enumeration were too high or too low. If, for example, too low a figure was reported, f would be greater than 1 and the percentage error would be 100 (f–1).

Since high correlation [6] generally exists between farmers' reports and data found in the checks, the ratio estimate gives good results with a relatively low sampling rate. Because of the requirement that estimates have a similar level of accuracy by regions, the number of farms checked is different from State to State. In the check on the 1952 land-use census the selection of villages was similar to that for the objective yield surveys. Sample villages for the entire country totaled about 790. This is a little more than 3.5 percent of all villages. Within villages, three farms were selected at random, with a control on the proportions of large and small farms. For these farms, experts made objective checks on practically all reported land-use data with respect to cultivation and commodity.

The check on the livestock enumeration was made in several States during recent years—Schleswig-Holstein, Lower Saxony, North Rhine-Westphalia, Württemberg-Baden, and Bavaria. For example, in March 1953, 70 villages from about 7,000 in Bavaria were selected at random by counties in proportion to numbers of hogs found. In each of these villages hog numbers were checked on six livestock farms.

Possibly future checks on the livestock enumeration should be made by multistage area sampling with area segments as sampling units. Pig numbers on livestock farms in those segments could be checked by an expert in half a day. Such a survey would have the advantage that boundaries of segments could be checked accurately. Moreover, it

[6] In a check on the 1952 land-use census, correlation coefficients larger than ±0.80 were found for the principal items (area in farmland, cropland, bread and feed grains). In the checks on the pig enumerations the correlation coefficients are also relatively high for individual age and sex classes; for the total pig population a value of +0.95 was actually determined.

might provide a means of learning whether livestock farms were skipped in the enumeration, because the check would be made on the area segment as the unit and not by livestock farms.

Summary

Results so far obtained in studies of sample surveys and sample tabulations in agricultural statistics indicate:

I. Sample Selection

1. If an up-to-date list of names and addresses is available, the sample design is governed only by the degree of precision needed and the costs. One would choose the design that gives greatest efficiency at minimum cost.

2. If the list is incomplete, or if no list is available, area sampling should be used. Here it is most important that the geographic area segments, which are the sampling units, be delineated accurately. When this sampling procedure is used for current surveys, the area segment must be kept constant from one survey to another.

3. If new farms, new livestock farms, or other such items are to be included in the sample (there being practically no list of such individuals at hand) there is no choice but to use area sampling.

4. When interviewers are used to make spot checks in agricultural statistics (for example, determining errors in censuses), multistage sample designs should be chosen, to reduce costs. But a geographic area under investigation may also be divided into such segments that an interviewer can complete his questioning in approximately 1 or 2 days. Segments to which interviewers are to be sent are then selected at random.

II. Overall Conclusions

1. If a previous complete enumeration is available, sample estimates can be derived from base data:

(*a*) By a simple expansion of the data from a stratified or pure random sample or an area sample. The estimate is computed by multiplying the sample average by the total number of units in the universe. In stratified sampling it is appropriate to weight by numbers of units in individual strata.

(*b*) By applying a ratio estimate to data from a stratified or pure random sample or an area sample, using data from a previous complete enumeration. With the ratio estimate instead of the simple expansion, an appreciable improvement in the estimates is achieved when there is a relatively high correlation[7] between the two sets of data (complete enumeration and sample).

2. When no previous complete enumeration is available, estimated totals can be derived only from simple expansion.

3. To discover the errors in censuses the ratio is most suitable because it is convenient to express the error as a percentage—100 (sample check/census)—and because a high correlation exists between farmers' reports and the sample checks.

III. Unification of Agricultural Statistics

It is apparent from the evidence that the individual agricultural enumerations stand isolated from one another. A policy that might be followed is suggested by M. Rauterberg (*8*), Federal Statistics Office, Wiesbaden; that is, to test whether or not an agricultural census should be taken every 5 years as a complete enumeration and to conduct intervening enumerations as sample surveys. The result would be a comprehensive and unified system of statistical surveys in official agricultural statistics in Germany.

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[7] If r is the correlation coefficient, C_x the coefficient of variability in the sample and C_y that in the base data, the ratio estimate is more efficient than the simple expansion when r is larger than (1/2) (C_y/C_x).

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Short-Time Price Movements of Farm Products

Day-to-day price fluctuations in the markets in which farmers sell result in windfall gains and losses that are inequitable as between farmers, and that arouse their suspicions of monopolistic manipulation of prices. These fluctuations would also appear to be symptomatic of frictions that might be eliminated in a more perfectly functioning market. If patterns could be found in these price movements that would enable farmers to anticipate and take advantage of them, this would improve the markets from the standpoint of farmers and contribute toward improving the responsiveness of supplies to prices. The research here reported, undertaken by the Illinois Agricultural Experiment Station under contract with the former Bureau of Agricultural Economics, was an attempt to discover such patterns. The attempt was unsuccessful. But because the problem is important, the negative findings are set forth for the information of others who may be interested in research in this area. This article was prepared by Richard J. Foote of Agricultural Marketing Service. It was based on the research report submitted by G. L. Jordan of the University of Illinois.

MANY PEOPLE who observe day-to-day prices in commodity markets believe that prices follow certain patterns of movement, or that their fluctuations can be traced to various causal factors. In an effort to discover relationships of this kind, analyses were made of fluctuations in prices of hogs, corn, and soybeans at terminal markets. The length of period studied varied from 1 to 14 days. Thirty-four separate hypotheses were tested, falling into 4 main types: Those that relate to (1) patterns in prices of the products, in prices of futures contracts (for corn and

soybeans), or in market receipts; (2) relations between cash and futures prices; (3) relations (for soybeans) between prices of beans and value of oil and meal; and (4) relations between prices and receipts. Presented here are representative examples from each type, including those that showed most promise.

Patterns in Prices

If many farmers made a practice of holding back shipments on a rising market until prices had risen for several days, prices would continue to go up, but then would react sharply when the accumulated supplies came to market. Four hypotheses relating to such short-time cyclical effects were tested. Results for corn and hogs are summarized here.

For No. 3 Yellow corn at Chicago, no significant relation was found between the deflated [1] price on a given day and the level 1, 2, and 3 days later. But continuous increases or decreases in prices of corn occur more frequently than would be expected in a random series. For those periods in which prices of corn rose or fell for 2 or more consecutive days, no relationship was detected between the duration of the movement and the amplitude of the first day's reaction following termination of the movement.

For the period October 1950 through December 1953, a 5-day moving total of day-to-day price changes was computed. The beginning of a price rise (or fall) was defined as the point at which this 5-day total was up (or down) by at least 3 cents per bushel. Thirty-four rising and falling phases were observed in this period. Their duration showed no clear modal behavior.[2] Nor did the average rise or fall appear to increase or decrease with the duration of the phase.

A pattern of sorts was found in prices of hogs. From 1949 through 1952, if prices at the National Stockyards on a given Monday were above those on the preceding Monday, in two cases out of three the average price for the week was higher than for the preceding week. For the separate years, the movements corresponded in from 63 to 70 percent of the cases.

Tuesday-to-Friday prices moved in the same direction as Tuesday in relation to Monday 54 percent of the time (48 to 59 percent in the individual years). Similar results for the remainder of the week were obtained when comparing Wednesday with Tuesday, Thursday with Wednesday, and so on. Under these circumstances farmers would gain somewhat over a random choice by using Monday-to-Monday price changes as a guide to the level of prices during the rest of the week. But they would gain only slightly over a random choice by following price changes within the week.

Results based on receipts of hogs were almost identical with those based on prices. Apparently, if farmers increase their shipments to market on a Monday over those of the preceding Monday, they are likely to increase their shipments for the entire week over those of the preceding week. Patterns in prices that were found can be assumed to reflect chiefly these tendencies with respect to marketings.

In studying phase lengths for hogs, a turning point was defined as the point at which prices changed in the direction opposite to the preceding movement by as much as 10 cents, or enough to reach the level on the day immediately previous to the low or high point. When this method of counting was used, 40 percent of the price movements were of 1 day's duration, 30 percent of 2 days' duration, 13 percent of 3, and 18 percent of 4 or more. When a change of 25 cents instead of 10 cents was used in defining a turning point, 26 percent of the price movements persisted for 1 day, 27 percent for 2, 12 percent for 3, 25 percent for 4 to 6, and 10 percent for 7 or more. These numbers differ from those that would be expected in a random series, but in general the phase lengths are neither long enough nor uniform enough to be of value to farmers in planning their marketings.

[1] In many analyses, prices were deflated by the index of wholesale prices of 28 basic commodities published in the *Weekly Supplement* to the *Survey of Current Business* issued by the United States Department of Commerce (interpolating, where necessary, to obtain daily figures). In a number of analyses, adjustments were made to allow for normal seasonal variation in both prices and receipts. Mention of these refinements is not repeated in succeeding examples.

[2] Of the rises, durations of 2 and 12 days occurred 5 times each; 7 days, 4 times; 5 days, 3 times. The remaining 17 rises ranged from 1 to 30 days, with no duration occurring more than twice. Of the falling-price phases, durations of 4, 5, and 6 days occurred 4 times each; 8, 10, and 13 days, 3 times each. The remaining 13 ranged from 1 to 18 days, with no duration occurring more than twice.

Results from studies of patterns in futures prices of corn were similar to those from the studies of cash prices. Similar hypotheses were tested for soybeans, with about the same results.

Relations Between Cash and Futures Prices

It is frequently stated that the price of a commodity is discovered first on the futures market but that the price in the cash market quickly adjusts to changes in futures. During the period covered by this study, there was no evidence that prices of cash corn rose or fell with rises or falls in the price of corn futures on the previous day. In October and November large daily changes in prices of cash corn were associated with a large volume of trading in corn futures, but the variation was great. For other months some relationship was found when median prices were used, but the scatter around the median was excessive. No significant relationship between volume of trading and daily changes in cash prices was evident the last 2 weeks before a delivery month.

It is sometimes asserted that the spread between prices of cash corn and prices of December corn futures is affected by receipts at primary markets and by the supply of corn per animal unit. Several approaches were used to study this hypothesis and, with some of them, some relationship was found. But observations were so few and correlations so low that no conclusions are justified.

A second hypothesis concerning factors that affect the spread between cash and futures prices is that a wide departure of the actual from the theoretical spread leads to prompt changes in cash prices in the direction that brings the spread closer to the theoretical. The theoretical spread was obtained by calculating the average difference between the price of December futures during the first 10 days of August and the cash price of No. 3 Yellow corn at Chicago on the same days. This spread then was reduced an equal amount each day so that on the last day of trading in futures in December the cash price was 1½ cents above the December future.

A statistical analysis was run for which the dependent variable was the percentage that the average cash price in the current week was of the price in the previous week. The independent variable was the difference between the actual and the theoretical spread for the preceding week. If this difference were large, prices should decline in the week under consideration so that the difference in that week would be smaller. Thus, if the hypothesis were true, an inverse relationship between the two variables would be expected. But positive correlations ranging from 0.1 to 0.5 were found for the 3 years used separately in the analysis.

The same type of analysis was run for May futures. Here a slight inverse relationship was found but it was not close enough to verify the hypothesis. A similar study was run for soybeans but no significant correlations were found.

Relationship of Prices of Soybeans to an Earlier Value of the Oil and Meal

Statistical analyses made by the Agricultural Marketing Service indicate that for 1931–40 and 1948–50 practically all of the variation in season-average prices received by farmers for soybeans can be explained by changes in the combined value of the oil and meal obtained per bushel crushed.[3] This suggested that short-term changes in the price of soybeans might be forecast from changes in the value of the oil and meal in an earlier period.

For the period October 1949 through September 1950, prices of soybeans at Decatur, Ill., on Tuesday through Friday were correlated with the value of 10 pounds of soybean oil and 48 pounds of soybean meal on the preceding Monday, with a separate analysis for each day. In all cases, more than 80 percent of the variation in prices was explained by changes in the value of the products. When the crop year was divided into two periods, the percentage of variation explained declined to 23 to 40 percent from October through January but during the rest of the marketing year, it was in the 85 to 95 percent range. An interesting modification of this study would have been to measure the

[3] The nature of the relationship has changed considerably in recent years, reflecting (1) the increased use of solvent extraction and the concomitant increased capacity of the crushing industry, and (2) the tendency on the part of farmers to market a smaller proportion of their beans immediately following harvest. However, it can be presumed that this value is still the major one that affects prices of soybeans. See SIMON, MARTIN S., SOYBEANS: ECONOMIC ANALYSES RELATING TO PROCESSING. U. S. Dept. of Agr. Marketing Research Report No. 35, 1953. Pages 30–32, 40–43.

association between week-to-week changes in prices of soybeans and Monday-to-Monday changes in the value of the products.

Relationship Between Supplies and Prices

The most obvious explanation of short-term price movements is that they are associated with short-term changes in supplies or market receipts. Many hypotheses related to this were explored. Some of those that relate to corn and hogs are discussed here.

One hypothesis is that when daily receipts of corn at all primary markets are larger (or smaller) than the seasonal pattern for the year, deflated prices of No. 3 Yellow corn at Chicago are lower (or higher) than the seasonal pattern for the year. This was also tested, using receipts at Chicago. An additional hypothesis is that there is some relationship between the amplitude of rises (or declines) in the volume of receipts corrected for seasonal and the duration of declines (or rises) in deflated prices corrected for seasonal. A third hypothesis is that there is some relationship between the weekly deflated price of corn and cumulative receipts as a percentage of the production of corn. No significant relations were observed for any of these hypotheses.

For hogs, likewise, several tests were made for relationships between short-term changes in supplies and prices. The closest was found between the ratio of the current price to that of the preceding day and the ratio of the current volume of receipts at the 12 major markets to the average volume for the same day in the preceding 1 and 2 weeks. If allowance is made for other influences, such as wholesale pork prices, the relationship appears to be linear. Volume figures at the National Stockyards alone gave less significant results.

Based on these studies, changes in supplies appear to have important effects on day-to-day changes in prices. Separate analyses were made for each month except November and December, when a strike that took place at packing plants affected the relationships. The relationship was closest in January through March and August through October. From April through July, short-term changes in supply appeared to have little influence. Poor results for these months may be due chiefly to limitations in data. The price data were for barrows and gilts, but the volume data included sows which become a more important component of supplies in late spring.

A similar set of analyses was run using shipments from the National Stockyards instead of receipts, or in addition to receipts. These shipments apparently have little direct effect on prices of barrows and gilts.

Several studies were made to learn whether the relationship between receipts of hogs and prices of barrows and gilts is inverse when both series relate to the same time period. Receipts at both the National Stockyards and the 12 leading markets were used. Data at the National Stockyards indicated that changes in Monday and Tuesday receipts from those of the preceding week and in Monday and Tuesday prices from those of the preceding week move inversely about two-thirds of the time. In working with receipts at the 12 markets, 3-week moving averages of the data for Monday and Tuesday were used in addition to the actual data. From May through December no definite inverse relationship between the two series was found when moving averages were used for each. From February through April only a slight degree of relationship was indicated.

Summary

A representative group of hypotheses dealing with the predictability of day-to-day price movements was tested for three commodities: corn, soybeans, and hogs. Many others might have been tested but those used in the study were representative. The general conclusion was that these short-term price movements are unpredictable. This implies that prices adjust almost instantaneously to changes that take place in the basic factors that affect the immediate supply and demand situation.

No significant relationships were found between short-term changes in receipts and in prices of corn. This would be expected of a storable commodity; if receipts were temporarily out of line with market requirements, an adjustment could be made at low cost by moving part of the supply into or out of storage.

For hogs, on the other hand, significant relationships were found between approximately simultaneous changes in receipts and prices. Hogs cannot be stored at low cost. When large supplies

come to market they must be either slaughtered at higher than normal costs or held over at the terminal market at considerable cost. When receipts are smaller than normal, packers attempt to buy as much as possible in order to keep their plants operating at efficient rates. Thus the differences between the commodities found in this phase of the study are consistent with expectations.

Book Reviews

The Measurement of Consumers' Expenditure and Behaviour in the United Kingdom, 1920–38. Volume 1. By Richard Stone. Cambridge University Press, New York. 448 pages. 1954. $18.50.

"THE FIRST CONDITION for the development of any branch of research is that it shall attract scholars of imagination and technical ability." So writes Professor Stone in the introduction to this impressive volume. Econometric research on demand has attracted many scholars of imagination and technical ability—Moore, Ezekiel, Schultz, Tinbergen, Frisch, Haavelmo, and Fox, for example. Now Professor Stone demonstrates that he belongs in the ranks of these men, and that in many ways he has gone beyond them.

Stone's book is a new landmark in demand research. In one huge volume he presents and criticizes the data on consumption and prices, explains the basic economic theory, develops the necessary mathematical and statistical principles, and summarizes more than 200 demand equations. Without doubt this is the most comprehensive book yet published in the field of statistical demand analysis.

Inevitably Stone's book will be compared with Schultz's well-known masterpiece.[1] As I see it, the two books have the same merits, and share the same major defect. Both books are excellent in their presentation of economic theory, mathematical techniques, and research results. In my opinion, the actual statistical analysis in both books is too mechanical and routine. More on this defect later.

More than half of the volume is used to present and criticize data on consumption, expenditure, and prices. This feature of the book distinguishes it from most publications in the United States. Here the statistician too often takes the data for granted. He can easily get published estimates of the prices and consumption of almost any commodity, and often knows little about their accuracy. Stone found it necessary to make many estimates, himself. This gave him a real appreciation of the reliability of the basic data, and of the kinds and degrees of error to be expected in various series. This important subject is badly neglected by most analysts in the United States who sometimes compute results to 5 or 6 "significant figures" without realizing that the data may be accurate to perhaps 2 or 3 significant figures.

Stone leans heavily upon Hicks [2] in his excellent treatment of the pure theory of consumer demand. It would be hard to exaggerate the importance of this theory. Basic research in demand requires an understanding of such concepts as total and marginal utility, indifference surfaces, and elas-

[1] Schultz, Henry. THEORY AND MEASUREMENT OF DEMAND. University of Chicago Press. 1938.

[2] Hicks, John R. VALUE AND CAPITAL. The Clarendon Press, Oxford. 1939.

ticities of substitution. Stone makes good use of these concepts when analyzing the degree of competition and substitution among commodities. He goes much further into these subjects than did Schultz. But neither Stone nor Schultz made full use of the theory. For example, neither of them derived an indifference surface.

The chapter on estimation problems and statistical procedures is excellent. Several different techniques are presented in compact matrix notation. Single-equation and simultaneous-equation techniques are explained. Attention is given to the problems of serial correlation and of errors in the data.

But then Stone, like Schultz, adopts one specific formula for all commodities and grinds out the results on the calculating machine. If there were some magic formula that explained the demands for all commodities, at all places and at all times, research in this field would be purely routine. All data could be fed into the electronic computer, together with standard instructions, and we would get the answers without need for thinking. Then we would not need to attract scholars of imagination and technical ability. But actually the economics of potato production, marketing, and consumption is quite different from the economics of the hog industry.

I have no special objection to Professor Stone's formula. If we want to force 200 different analyses into the same standardized straitjacket, perhaps Stone's formula is no worse than most alternative formulas. But this sort of mass-produced standardized research is likely to overlook many things. I doubt if all analyses should be made in terms of first differences of logarithms. I suspect that the simultaneous-equation approach is needed in studying some commodities. I suspect that "income elasticity" over time may differ from that based upon family-budget data. Let's keep our methods flexible. Let's try to understand the economics of each commodity and use whatever methods are appropriate to a particular case.

This is the first volume in a series of reports. Four additional volumes are scheduled for publication soon.

Frederick V. Waugh

Farm Management Analysis. By Lawrence A. Bradford and Glenn L. Johnson. John Wiley & Sons, Inc., New York. 1953. 438 pages. $5.75.

Principles of Farm Management. By H. C. M. Case and Paul E. Johnston. J. B. Lippincott Company, Philadelphia. 1953. 466 pages. $6.

WHAT FARM MANAGEMENT IS and what it does have always been elusive concepts to agricultural economists. In *Farm Management Analysis*, a new college text, Bradford and Johnson bring together the results of their excellent researches and thinking on this complex subject. The first three chapters define and describe management in a lucid, thought-provoking and, at times, philosophical manner. The authors conclude that management consists of (1) observing and conceiving ideas, (2) analyzing and further observation, (3) making decisions, (4) taking action, and (5) accepting responsibility (for action).

A major effort is made by the book to combine the best features of the "traditional" and "modern" approaches to analysis. The latter is regarded as an extension, not a replacement of the former. The traditional approach is to observe the organization and practices of successful farms which then become the standard for establishing or improving individual farms. In the modern approach, the maximizing problem is solved by marginal analysis, simultaneous equations, and related techniques.

In the combination approach, traditional procedures can be used to provide good first approximations of successful organization and practice. Fixed factors—land, family labor, capital, personal capacity—are powerful determinants. They lead to the "labor-use" approach or to the "land-use" approach, which the authors prefer as the more generally applicable. These first approximations are then refined through modern techniques, completing the combination.

Many readers will agree with the authors' state-

ment in their preface that the blending of approaches is not yet completely satisfactory. The volume appears to have alternate blocks of three to four chapters which cover the traditional and modern approaches. One difficulty with the modern—the marginal approach—is the general lack of suitable data with which to make the necessary analyses. But the new techniques do provide a useful framework for a manager in thinking through his problems. This alone strengthens the older procedures. Moreover, the modern tools permit us to measure separately the returns to investment and those to management and labor. Accurate further separation between management and labor awaits the development of suitable tools.

The last five chapters represent additional essays on management tasks, managerial principles, getting a farm, farm and home planning, and "miscellaneous conceptual problems involving management." These discussions, although highly relevant, are not too well integrated with the main body of the volume. They appear to be more related to the early chapters that define management, but they will be useful to resourceful instructors.

In *Principles of Farm Management*, which is designed as a college text, Case and Johnston bring together the results of many years of successful teaching and research in Illinois. It gives faithful attention to definitions, and it includes the usual review questions and references at the end of each chapter. Six appendixes cover such subjects as rotations and fertility balance, work exercises, systems of handling feeder cattle, feed standards, types of farming in Illinois, and directions for calculating selected farm-analysis factors. All of this is useful material for both student and instructor. The book is well illustrated and attractive. Much of the illustrative data comes, as it should, from extensive farm-account records collected by the Illinois staff.

Farm Management is defined as, ". . . the efficient organization and skillful operation of a farm . . . for . . . maximum continuous profits . . . ." The central core of management is farm planning, the process by which a farmer decides what resources to use and how to use them. Chapters 4 through 11 take the reader through the six logical steps in planning, beginning with appraisal of the firm's resources, especially land. The chapters on fitting the land use and cropping system to the farm are the best this reviewer has seen. Chapters 11 to 18 discuss types of farming in the United States, use of economic information, farm records and their uses, farm finance, tenancy, farm leases, and other subjects.

This book can be identified with the "practical approach"—it is a practitioner's book. The principles are based on observation of successful Corn Belt farms. The book is designed for beginning students. Instructors will find it especially useful for students in agriculture who are not majoring in economics. Supplementary reading in economic theory would be needed for majors in economics.

Warren R. Bailey

Principles of Appraisal. By Giuseppe Medici. Iowa State College Press. 254 pages. 1953. $3.50.

THIS ENGLISH TRANSLATION of portions of *Principi di Estimo* provides one of the few opportunities for agricultural economists in America to sample current works of their European counterparts. Dr. Medici is head of the Department of Appraisal, University of Naples. He has written several books on this subject. Although the general approach in this book is similar to that used in American texts on farm appraisal, Dr. Medici gives more attention to the theoretical framework of appraisal. Throughout, he shows keen awareness of the limitations of even the best appraisal procedure. The meaning of value and the various kinds of value applicable to farmland are stressed in early chapters as are the essential elements of logic that must be embodied in the appraisal approach.

Dr. Medici argues that farm appraisal can never become a science in the narrow meaning of the word but that a scientific method can be developed. He points out the complementary nature of the casuistic or case approach and theoretical appraisal, feeling that neither in itself is sufficient. The limitations of the mathematical formula ap-

proaches of Aereboe and Rothkegel, which rest heavily upon physical characteristics of land, he sees as unrealistic in many parts of Italy where subjective considerations are modifying factors. This observation would be equally valid in many areas of the United States where market values of farmland bear little relation to income from land.

The book is divided into two sections—general appraisal and special appraisal. Chapter III in the first section discusses the five economic aspects of an object of wealth: Market value, cost of reproduction, transformation value, substitution value, and complementary value. Although the four values tend to converge toward the market value, numerous forces prevent the attainment of perfect equilibrium.

Special mention can well be made of the author's discussion of complementary value because of its application to conditions in the United States. He observes a common tendency in parts of Italy for small tracts of land to have market values well above those determined by the capitalization of land income. This stems from the inclination of farmers who do not have sufficient land for best use of available labor to capitalize a part of the increased labor return that would be possible from an additional tract into their valuation of that tract. The active market in land for enlargement of farms that has accompanied farm mechanization in this country is basically similar.

The discussion of analytical appraisal is based on the well-known capitalization formula, in which customary rental rates and landlord's expenses are utilized to obtain net land income. Considerable discussion is devoted to the limitations of net rental income as a basis for capitalized value, and to the choice of the proper rate of capitalization.

Those concerned with special aspects of appraisal will find that the chapters on land improvements, the repartition of land-reclamation contributions, water for irrigation, and forage crops, provide new viewpoints for American specialists who are concerned with such appraisal problems. Minor translation difficulties and the use of special terminology do not detract from the basic usefulness of the book.

William H. Scofield

The World Wheat Economy, 1885–1939. By Wilfred Malenbaum. Harvard University Press, Cambridge, Massachusetts. 262 pages. 1953. $6.

A MORE OPPORTUNE TIME for publishing this history and analysis could not have been chosen, coming as it does as the world wheat economy faces again a surplus position characteristic of prewar years. The book provides valuable background for economists and administrators in evaluating current and prospective problems and in seeking solutions to them.

The "world" of Mr. Malenbaum's book excludes those "areas in which wheat production, consumption, trade, etc., were almost entirely of relevance within the area itself, areas whose output had few implications for the international wheat economy." This is, of course, the traditional delineation of the "world wheat economy."

Mr. Malenbaum's central thesis is that, over the period he analyzes, a long-run tendency toward disequilibrium between supply and demand found expression in declining prices. Moreover, this persistent tendency toward overproduction was motivated not so much by economic forces as by institutional forces such as actions of government and expansion of frontiers. The contribution of this book to economic literature pertaining to wheat lies in its careful and systematic treatment of this thesis. Emphasis is on supply, with relatively brief treatment of demand aspects. The analysis is long-run, couched in classical equilibrium terms, with little emphasis on short-run phenomena.

Essentially, the book contains little that is new; but all that is known is there, presented in a readily available, compact form. It leans heavily on the *Wheat Studies* of the Food Research Institute of Stanford University, Jasney's *Competition Among Grains*, and de Hevesey's *World Wheat Planning and Economic Planning in General.* This is not adverse criticism—the synthesis of findings of many persons itself is a contribution. But in the sense that demand is relegated to a minor position the book does lack balance. The income and price

elasticities that are presented are essentially those determined by other research workers.

The confidence that Mr. Malenbaum at times places in general equilibrium theory may be questioned. He states, for example, that "insofar as actions of people are the determining factors, acreage movements (supply responses) will always be consistent with the changing demand; there will be moving equilibrium positions over time. Significant imbalance between production and consumption might occur only because of climatological variations and the yield fluctuations accompanying them." And he draws the inference that in the absence of political intervention "the maladjustments are short-run; no factor operates systematically to disturb the longer-period equilibrium between quantities demanded and the larger acreages needed to provide them." But he cites no evidence that the supply-response mechanism left to itself would produce such a continuous moving equilibrium.

Although the work is essentially concerned with events from 1885 through 1939, the author, in the concluding chapters, discusses current international problems and solutions and appraises the future of the world wheat economy. The appraisal of future prospects is on a sectional basis and cannot be easily summarized here. With reference to the United States, however, the author concludes that the equating of existing and potential supplies with effective demand at prices remunerative to producers without accumulation of stocks is conditioned upon continuation of the various foreign assistance programs that have characterized the postwar period.

This useful and well-documented analysis is recommended to readers who are interested in the domestic or world wheat economy.

Kenneth W. Meinken

Sample Survey Methods and Theory. By Morris H. Hansen, William N. Hurwitz, and William G. Madow. Vol. I, *Methods and Applications.* 638 pages. $8. Vol. II, *Theory.* 332 pages. $7. John Wiley & Sons, Inc., New York. 1953.

THESE TWO BOOKS comprise the most nearly self-contained work on sampling currently available. Both are good books, but only volume I is reviewed here.

The introduction and first three chapters of volume I present certain criteria for judging the need for and worth of a survey, basic definitions and principles, kinds and sources of biases and nonsampling errors, and the effect upon sample design of special properties of the population to be sampled and the amount of information available concerning it. Chapters 4 through 7 follow a characteristic pattern: notation, the sample estimators, their variances, and sample estimates of the variance of sample estimators for simple random sampling, stratified simple random sampling, simple one- or two-stage cluster sampling, and stratified single- or multi-stage cluster sampling.

Chapter 4 introduces ratio estimates as well as sampling rate expansion estimates, and examines the factors affecting their respective precisions. Chapter 8 discusses the effects of unequal size clusters and the use of ratio estimates, stratification, and varying probabilities to minimize such effects. Small samples from large populations may call for large primary sampling units, because of considerations of cost. The resulting problems of allocating the sample so as to best control costs and estimator variance, and of obtaining sample estimates of variance are discussed in Chapter 9.

It is not sufficient to know for each estimator that there is a sample estimate of its variance; the user of any sample survey method has to decide how important and how accurate his sample estimate of estimator accuracy must be. Chapter 10 contains a discussion of factors affecting this accuracy and suggests a number of tricks in estimating variances.

Chapter 11 is a collection of assorted special sampling devices and procedures including regression estimates, double sampling, sampling for time series, systematic sampling, and variances of certain simple functions of estimated means. It is intended to be more suggestive of the ingenuity required in designing samples for particular problems than exhaustive of special techniques. Nat-

urally, discussion is brief. Considering the fairly frequent use of systematic sampling, discussion of this sampling method might well have been elaborated.

A collection of examples that illustrate the use of principles and techniques presented earlier in the book is to be found in Chapter 12 of volume I.

Chapter 12 of volume II, called "Response Errors in Surveys," might well be read at this time. Where it now occurs it seems to this reviewer to be out of place.

Anyone who must design surveys should read this two-volume work; those who must conduct or interpret results of surveys would do well to read much of volume I. The authors assume that readers of the volume on *Methods and Applications* have had only an elementary course in statistics and have an interest in the subject, and persistence. More than a little persistence is required to digest all that is contained in these 638 pages, not because the style is laborious but because the extent of valuable information found here is simply enormous.

Readers who are new to the subject may find the going somewhat easier if they will read chapters 1 to 3, possibly chapters 4 and 5, of volume I and then turn to a book such as W. G. Cochran's *Sampling Techniques*. Having read Cochran from cover to cover, they might return to volume I of *Sample Survey Methods and Theory*. Volume II, *Theory*, presupposes mathematical training through college algebra and some knowledge of calculus; it provides mathematical proofs and derivations in support of the results presented in volume I.

Glenn L. Burrows

Refrigeration in America: A History of a New Technology and Its Impact. By Oscar Edward Anderson, Jr. Published for the University of Cincinnati by Princeton University Press, Princeton, N. J. 1953. 344 pages. $6.00.

REFRIGERATION became an important factor in the American food supply about 1830, after the invention of a horse-drawn ice cutter which permitted the mechanization of ice harvesting. Mr. Anderson traces the development of the industry from these modest beginnings to the present, when refrigeration has become a major factor in food distribution and is applied to such diverse uses as air conditioning, laboratory research, surgery, and smelting iron ore.

The refrigeration industry presents a picture of technological displacement and revolution that is paralleled in many other industries. This study is useful as an example of such change in that the author presents technological developments in an understandable form.

Hardly had the natural ice industry become established when the production of ice by mechanical means displaced it except in particularly favorable areas. The theoretical background for the development of mechanical refrigeration was provided largely by Europeans, the practical application by Americans. At the same time that mechanical devices for manufacturing ice were being perfected, refrigeration systems that did away with ice were coming into use. And, as the author suggests, the end of such technological changes is not yet in sight.

Several chapters in the volume trace the application of refrigeration to food supply and distribution. As more products were cooled or frozen, better techniques had to be developed to meet the many problems that arose. Mr. Anderson gives credit to the United States Department of Agriculture for its outstanding work in these areas. He points out that there are still problems to be

met in the refrigerated storage and distribution of food and that the Department of Agriculture is one of the major agencies doing research on the problems.

One purpose of history is to show "how we got where we are today," and in so doing enable us to view our problems with a better understanding of their nature. Mr. Anderson has done just that, and has provided a valuable tool for those seriously concerned with problems of food distribution and marketing.

Wayne D. Rasmussen

Thomas Jefferson's Farm Book With Commentary and Relevant Extracts From Other Writings. Edited by Edwin Morris Betts. Published for the American Philosophical Society by Princeton University Press, Princeton, New Jersey. 730 pages. 1953. $15.

THOMAS JEFFERSON has always been of interest to the United States Department of Agriculture and to farm groups, because he was the first articulate exponent of agrarian principles to become President of this Nation. The Department's interest has been shown, among other things, by naming its auditorium in his honor, by sponsorship of a tour of agricultural people to Monticello in 1944, and through the publication in 1943 of a sourcebook of Jefferson's agricultural writings under the title *Jefferson and Agriculture.*

The sourcebook was edited by the late Everett E. Edwards of the Bureau of Agricultural Economics, one of the Nation's outstanding scholars with respect to Jefferson's farm activities and agrarian philosophy. One of the last tasks carried out by Mr. Edwards was a review of the manuscript of this volume.

Thomas Jefferson's *Farm Book* makes up the first 178 pages in the volume and is presented in facsimile. This memorandum book contains entries dating from 1774 to 1826. The story of Jefferson's farm operations is not presented as a year-by-year account. Rather, the volume contains notes of Jefferson's observations on particular topics, lists of slaves and supplies issued to them, and rules for various farm activities. Occasionally, Jefferson noted his farm activities in the form of a chronological diary but such entries are neither continuous enough nor in enough detail to permit the farm economist, particularly the specialist in farm management, to analyze his operations.

It has been said that Jefferson was our first farm economist. Certainly he kept records of work required to perform different farm operations and many farm accounts by which he attempted to determine costs. This had a very practical side for, as the extracts from correspondence indicate, Jefferson was under constant economic pressure. Thus, he was forced to grow wheat and tobacco as cash crops even while he deplored their effects upon the soil. Even then, income did not always match expense and Jefferson was sometimes forced to balance his accounts through selling land.

Introducer of plants from abroad, inventor of improved farm machinery, exponent of better production methods, and soil conservationist as well as agrarian politician, Jefferson is of interest to everyone interested in farm problems. Mr. Betts, the editor of this volume, has captured many of these facets of Jefferson's life, and for so doing we owe him and the publishers our gratitude.

Wayne D. Rasmussen

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges [1]

CHARLTON, J. L. SOCIAL ASPECTS OF FARM OWNERSHIP AND TENANCY IN THE ARKANSAS COASTAL PLAIN. Ark. Agr. Expt. Sta. Bull. 545, 85 pp., illus. Southwestern Regional Bull. 4. (Agr. Expt. Stas. of Ark., La., Miss., Okla., and Texas, Farm Foundation, and U. S. Dept. Agr. cooperating.)

Compares, by tenure classes, ownership of farm property—owners possess land, machinery, and work stock; renters possess machinery and work stock; and sharecroppers possess only hand tools. Discusses income and level of living by tenure classes and describes the tenure process.

DARRAH, L. B., AND CARPENTER, K. S. EGG MERCHANDISING STUDIES IN SUPERMARKETS. PART III: WINDOWS IN EGG CARTONS. Cornell Univ. Agr. Expt. Sta. A. E. 955, 8 pp., illus. July 1954. (AMS cooperating.) (RMA)

Results of this study indicate that customers prefer egg cartons with windows to nonwindowed cartons and that windows in cartons affect egg sales.

DWOSKIN, P. B., BAYTON, J. A., AND HOOFNAGLE, W. S. CHANGING PATTERNS OF MILK CONSUMPTION IN MEMPHIS, TENN. U. S. Dept. Agr. Mktg. Res. Rept. 69, 77 pp., illus. June 1954.

Sales of fluid milk in the Memphis market trended downward from October 1950 to September 1952, then increased. Reasons for the increase include lower retail prices, increased promotional activity, and shifts in distributors' selling practices.

FEDER, ERNEST, AND WILLIAMS, SHELDON W. DAIRY MARKETING IN THE NORTHERN GREAT PLAINS—ITS PATTERNS AND PROSPECTS. S. Dak. Agr. Expt. Sta. Bull. 438, 59 pp., illus. North Central Regional Pub. 47. May 1954. (Agr. Expt. Stas. of Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., and Wis., and AMS cooperating.)

Deserihes general importance and economic role of dairying in four States; points out differences between marketing in this area and other areas; appraises future of dairying, emphasizing the shift from farm-separated cream sales to whole milk sales.

GARLOCK, F. L., JONES, L. A., BIERMAN, R. W., AND SCOFIELD, W. H., under the direction of NORMAN J. WALL. THE BALANCE SHEET OF AGRICULTURE—1954. U. S. Dept. Agr. Agr. Inform. Bull. 134, 29 pp., illus. August 1954.

Tenth in a series of annual reports that carry forward the comparative balance sheet of agriculture.

HAY, DONALD G., and HAMILTON, C. HORACE. ACCEPTANCE OF VOLUNTARY HEALTH INSURANCE IN FOUR RURAL COMMUNITIES OF HAYWOOD COUNTY, NORTH CAROLINA, 1953. N. C. Agr. Expt. Sta. Progress Rept. Rs–24, 53 pp. September 1954. (AMS cooperating.) (Processed.)

Two-thirds of the 299 households studied reported some health insurance. Social status characteristics of individuals were studied as to their association with insurance enrollment.

HAY, DONALD G., and HAMILTON, C. HORACE. ENROLLMENT IN VOLUNTARY HEALTH INSURANCE IN NORTH CAROLINA, 1953. N. C. Agr. Expt. Sta. Progress Rept. Rs–23, 10 pp., illus. September 1954. (AMS cooperating.) (Processed.)

At the end of 1952, about two-fifths of the population of North Carolina carried voluntary health insurance for hospital care, more than one-third for surgical care, and 1 out of 20 for other medical expenses.

HESTER, O. C., and HARPER, W. W. THE FUNCTION OF FEED-DEALER SUPPLIERS IN MARKETING GEORGIA BROILERS. Georgia Expt. Sta. Bull. 283, 39 pp., illus. August 1953. (BAE cooperating.)

The chief concern of feed dealers is selling feed, but in developing feed outlets they became involved in broiler finance. Extent of their investments in the broiler industry of Georgia is indicated by the fact that less than 2 percent of the growers operated on a cash basis in 1951.

HOLTON, RICHARD. THE SUPPLY AND DEMAND STRUCTURE OF FOOD RETAILING SERVICES. A CASE STUDY. An Agricultural Marketing Act (RMA, Title II) Contract Report. Harvard Univ., Harvard Studies in Marketing Farm Products Number 10–H, 64 pp., illus. June 1954.

Discusses food retailing services in Stoughton, Mass., and changes in stores and in consumer demand for services between 1940 and 1950

HOOS, SIDNEY. PRICES AND MARKETING MARGINS FOR FRUITS AND VEGETABLES. 2. WEEKLY PRICES AND RETAIL MARGINS—SMALL, MEDIUM, AND LARGE STORES; ORANGES, LEMONS, AND GRAPEFRUIT; DENVER, AUGUST 1948–JULY 1949. Calif. Agr. Expt. Sta., Giannini Foundation of Agr.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

Econ. Mimeog. Rept. 170, 150 pp., illus. September 1954. (AMS cooperating.) (Processed.) (RMA)

Summarizes results obtained from some analyses of the behavior of weekly prices of the three major citrus fruits.

HOUSEMAN, EARL E., and REED, T. J. APPLICATION OF PROBABILITY AREA SAMPLING TO FARM SURVEYS. U. S. Dept. Agr. Agr. Handb. 67, 25 pp., illus. May 1954.

Endeavors to bring out important points that need attention in the application of probability area sampling and to relieve misapprehensions on other points. Indicates how probability area sampling can be adapted to a number of special cases.

JOHNSON, DEHARD B. AVAILABILITY AND DISPLAY OF FROZEN FOODS IN RETAIL STORES IN WASHINGTON, D. C. U. S. Dept. Agr. Mktg. Res. Rept. 73, 30 pp., illus. August 1954. (RMA)

There were 153 different items of frozen food on sale in the 27 sample stores; only 21 of these items were carried by all the stores. Sales of frozen foods for the 6-week period averaged $0.27 per square inch of display space in small stores, $0.39 in medium stores, and $1 in large stores.

LINDSEY, QUENTIN W. FARM TENURE: THE FRAMEWORK FOR LONG-RUN ADJUSTMENTS IN SOUTHEASTERN AGRICULTURE. N. C. Agr. Expt. Sta. Tech. Bull. 110, 54 pp., illus. Southeast Land Tenure Research Committee Pub. 13. August 1954. (ARS cooperating.)

Contends that the tenure system is the framework within which long-run adjustments must occur; agricultural adjustments have not kept pace with adjustments in other regions; a more rapid rate of growth of the productive potential in the Southeast is possible; and more land and capital goods per farm must accompany a decline in farm labor force if farm income is to improve and productive potential to be realized.

LOFTIN, MARION T., and GALLOWAY, ROBERT E. THE USE OF HEALTH SERVICES BY RURAL PEOPLE IN FOUR MISSISSIPPI COUNTIES. Miss. Agr. Expt. Sta. Sociology and Rural Life Series No. 5, 128 pp., illus. March 1954. (BAE cooperating.) (RMA)

Discusses the health practices and the use of selected types of health and medical services and facilities by 909 rural families in Bolivar, Choctaw, Forrest, and Lee Counties.

MOFFETT, WOODSON W., JR., COLLINS, WARREN E., MEENEN, HENRY J., ALEXANDER, WILLIAM H., GARBARINO, ANGELO J., HALPIN, ROBERT B., JENKINS, LEWIS P., and PENNY, NEWTON M. THE EFFECT OF METHODS OF PAYING FARMERS FOR MILK ON SEASONALITY OF PRODUCTION IN SELECTED SOUTHERN MARKETS. Southern Cooperative Series Bull. 37, 22 pp., illus. June 1954. (Agr. Expt. Stas. of Ala., Ark., Ga., La., Miss., N. C., S. C., Tenn., and Texas, and AMS cooperating.)

Analyzes the pricing plans used in the South for paying farmers for fluid milk.

OGREN, KENNETH E. THE FARMER'S SHARE OF THE CONSUMER'S FOOD DOLLAR. U. S. Dept. Agr. Leaflet 123, 7 pp., illus. Revised October 1954.

In 1953, consumers paid out, on the average, $1,002 for a family "market basket" of food. For the produce going into this food basket, farmers received, on the average, $452.

PETERS, C. W., REED, ROBERT H., DOUE, STEPHEN M., AND CLARK, RICHARD H. MEAT PURCHASES AND PREFERENCES IN HAWAII. Hawaii Agr. Expt. Sta. Agr. Econ. Bull. 8, 40 pp., illus. (Agr. Expt. Stas. of the Western States and AMS cooperating.) June 1954. (RMA)

Gives information on meat consumption, effects of income and racial background on meat purchases, and preferences for island meats and meats imported from the Mainland.

POULTRY MARKETING TECHNICAL COMMITTEE. FINANCING PRODUCTION AND MARKETING OF BROILERS IN THE SOUTH. PART I: DEALER PHASE. Southern Cooperative Series Bull. 38, 71 pp., illus. June 1954. (Agr. Expt. Stas. of Ala., Ark., Ga., La., Miss., N. C., S. C., Tenn., Texas, and Va., and AMS cooperating.) (RMA)

Discusses the methods of financing used in the broiler industry and suggests possible improvements in methods of financing.

RASMUSSEN, WAYNE D., AND BAKER, GLADYS L. A CHRONOLOGY OF THE DEPARTMENT OF AGRICULTURE'S FOOD POLICIES AND RELATED PROGRAMS, JANUARY 1952 TO DECEMBER 1953. U. S. Agr. Mktg. Serv. 89 pp. October 1954. (Processed.)

RINDLER, LESTER, AND MIRENGOFF, WILLIAM. UNEMPLOYMENT OF HIRED FARM WORKERS IN PINE BLUFF, ARKANSAS, MAY 1952. U. S. Dept. Labor, Bur. Employment Security. 26 pp., illus. August 1954. (ARS cooperating.)

Measures the extent to which seasonal farm workers living in Pine Bluff are unemployed and underemployed and their availability for additional employment.

SNITZLER, JAMES R. TRANSPORTATION OF APPLES IN THE APPALACHIAN BELT, 1952–53. 46 pp., illus. U. S. Agr. Mktg. Serv. August 1954. (Processed.) (RMA)

During the 1952–53 season, approximately 92 percent of the total sales of apples reported in the sample were shipped by truck and 8 percent by rail. Very large shippers made greatest use of rail transportation; small shippers relied on trucks. For-hire trucks hauled about twice as many apples as private trucks.

Winter, J. D., Nylund, R. E., and Cox, R. W. marketing fresh sweet corn in the midwest. Minn. Agr. Expt. Sta., Sta. Bull. 427, 28 pp., illus. June 1954. North Central Regional Pub. 45. (Agr. Expt. Stas. of Ill., Ind., Iowa, Kans., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., and Wis., and AMS cooperating.)

Gives results of studies on the effects of cooling, handling methods, and packaging films on quality and costs of handling by these methods; also the effect of methods of packaging and merchandising of properly cooled sweet corn on sales and consumer acceptance.

Wright, R. C., Rose, Dean H., and Whiteman, T. M. the commercial storage of fruits, vegetables, and florist and nursery stocks. U. S. Dept. Agr. Agr. Handb. 66, 77 pp. September 1954.

Presents brief summaries of the essential average storage requirements of important fresh fruits, vegetables, and cut flowers, and certain other horticultural crops.

Statistical Compilations

Banna, Antoine. oilseeds, fats and oils, and their products, 1909–53. U. S. Dept. Agr. Statis. Bull. 147, 234 pp. June 1954. (RMA)

Miller, Earl E. regional trends in livestock numbers. U. S. Dept. Agr. Statis. Bull. 146, 64 pp. August 1954.

United States Agricultural Marketing Service. poultry and egg statistics, 1953. 23 pp., illus. October 1954.

United States Agricultural Marketing Service. supplement for 1954 to statistics on cotton and related data, u. s. d. a. statistical bulletin no. 99. U. S. Dept. Agr. 94 pp. September 1954.

A mimeographed index for volume 6 is now available upon request from
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